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A Reliable Supply

THE wisdom of concentrating the power required for our main-line railways in a few generating stations was bound, soon or later, to be called in question. Doubters have pointed out that the number of stations is being progressively reduced, also that taking electricity from the grid will involve dependence upon many miles of overhead line, the implication being that this combination is likely to make the service less secure.

British railways have earned a very high reputation for reliability—a reputation we certainly would not care to see lessened in any way due to electrification; neither would we care to witness the reactions on other uses of electricity that would be caused by any failure of electricity to maintain the present high standard.

Good as the record of the railways is, it is no better than that of the majority of supply undertakings. To take an example almost at random, there has been no failure of supply in Cork, due to breakdown of plant, during the whole of its 33 years of operation. Even during the worst coal shortage throughout the war, the station was kept going by burning smoke-box ashes and tar on chain-grate stokers.

There will, no doubt, be difficulties in the very early portion of the 20-year period during which the change-over of the railways to electrical working will take place, just as there have been difficulties in many instances when small generating stations have been shut down in favour of bulk supplies. These "snags" have, however, proved to be of a temporary nature only, and they are not anything like so prevalent as they were when the technical aspects of transmission and conversion were less well understood.

The same question of the relative reliability of locally and centrally produced power used to be raised a quarter of a century ago by industrialists when urged to abandon private works plants and to take electricity from the public mains. After some initial hesitation they found, in increasing numbers, that the balance of advantages lay in purchasing electricity, even in the many cases in which continuity of supply was of much greater importance than any saving in the cost of power.

Comprehensive data as to the reliability of prime movers are not published for Great Britain, but returns by the National Electric Light Association of America show that, apart from time taken in routine overhaul, the number of hours in which large steam turbines are not available for carrying load represents less than 3 per cent. of the possible amount. These "outages" are not the same things as interruptions in the supply, the frequency of which there is no means of ascertaining, unless we assume that it is in a similar ratio to outages as has been found to exist for high-voltage transmission systems, *i.e.*, not much more than one-half. Experience in this country in regard to reliability of conversion is that one breakdown per 100 transformer years may be

expected and that while overhead lines are not so free from trouble as are the admittedly reliable cables, the time taken to locate and repair a fault is so much less as very greatly to offset any advantage of the cable. It may be regarded simply as a matter of experience that interconnection actually increases the security of supply, and we need have no fear that the railways when electrified will not be as well and as reliably served as are other consumers who place their entire trust in electricity in every way of life.

Fewer Orders for Plant

NOT all electrical plant manufacturers have been favourably affected by the progress of the national grid scheme. One of the exceptions is to be found in the Brush Electrical Engineering Co., Ltd., which earned reduced profits last year largely because its engineering department was far from fully occupied through restriction of orders for generating plant. Lord Vaux of Harrowden, the chairman, said, on Monday last, that many of the power stations which, in the normal course of things, would have required Brush-Ljungstrom turbine-driven sets for extensions had been precluded from placing orders as they would soon be taking bulk supplies from the grid. The company, however, unwilling to be beaten, took measures for the production of its turbines in larger sizes, and so shaped its affairs that it was ready by the end of the year to produce plant up to 50,000 to 60,000 kW capacity. Happily the company has been busy in its rolling stock and transformer departments; it has also developed a line of geared turbines. When demand revives it will be able to supply both very large and small plants, as well as those of medium sizes which it has long been producing

The Engineering Industry

THE refusal of the trade unions connected with the engineering industry to accept the employers' modified proposals for the alteration of wages and conditions, may have serious consequences. The need for the suggested revision was described by the employers as urgent, and their view is supported by the reports now being issued by the engineering firms. While one may sympathise with the men, who, as the employers have admitted, are badly paid in comparison with many less skilled or unskilled workers, the fact remains that the industry has been badly hit and must reduce its costs to continue to exist. It is regrettable that the proposed modifications should be necessary, but if the only alternative is the closing of works what can the industry do? A stoppage would work nothing but harm to both sides and to the community, and we feel certain that common-sense counsels will prevail and that a way out will be discovered even at this stage.

The Contractors' Meeting

THE E.C.A. and Allied Associations are going to the South Coast (Eastbourne) for their sixth annual conference towards the end of next month and a record attendance is anticipated. As will be seen from the details given in this issue, which we have extracted from the preliminary programme, the arrangements follow closely the lines of previous meetings. That is, the President's reception and dance on the first evening, a full day of business concluding with a smoking concert, and combined business and pleasure on the third day, when after the morning session there will be a garden party, followed later by a ball and supper. There are to be two papers and neither is of a technical character. An unusual feature is that both papers are by officials of the Association. The one to be read by Alderman R. Tweedy-Smith naturally deals with the law, while the general secretary, Mr. L. C. Penwill, intends to impart some information on that matter of perennial interest (and often pain) to electrical contractors—" fair trading." The Contractors' annual gathering is always a pleasant function, free from rigid formality, and members of the Associations can go to Eastbourne certain of deriving a great deal of profit and pleasure.

The I.M.E.A. Convention

THE general arrangements for the I.M.E.A. Convention at Scarborough follow the well-established lines that have proved so successful in the past, the technical and social aspects being blended in about the same proportions. As was the case last year there will be four papers apart from the presidential address. These deal with the " live " subjects of the cost of home service, rating, the value of the lighting load, and the future of the distribution of electricity. In the last named Mr. A. Nichols Moore intends, we hope, to develop the radical arguments brought forward in his presidential address in 1929 in favour of larger regionally controlled areas. We regretted then that no official discussion could take place on so stimulating a subject. We trust that the views expressed by those taking part in the discussion at Scarborough will be as carefully thought out as the importance of the subject to the future of the industry requires.

Supply Choice

No restrictions whatever should be placed upon prospective consumers with regard to their choice of supply, electricity or gas, for any given service. Though electrical development here was, in earlier years particularly, handicapped by the fact that the gas industry was deeply entrenched, it is also a fact that the electricity supply industry owes some of its advance to the keen competition with the gas supply, and from that point of view alone the presence of the rival is good. There is another consideration, however, involving the important question of prestige. Several complaints have been made of late about certain municipal authorities with their own electricity undertakings rendering it impossible, or at least difficult, for householders on new building estates to obtain gas supplies. Such action leads to the taunt, justifiable or not, that undue preference is given to the authorities' own child. Subject to reservations assuring fair-play, we, of course, hold emphatically that a supply authority should avail itself of every opportunity to secure new consumers.

The E.H.P. Conference

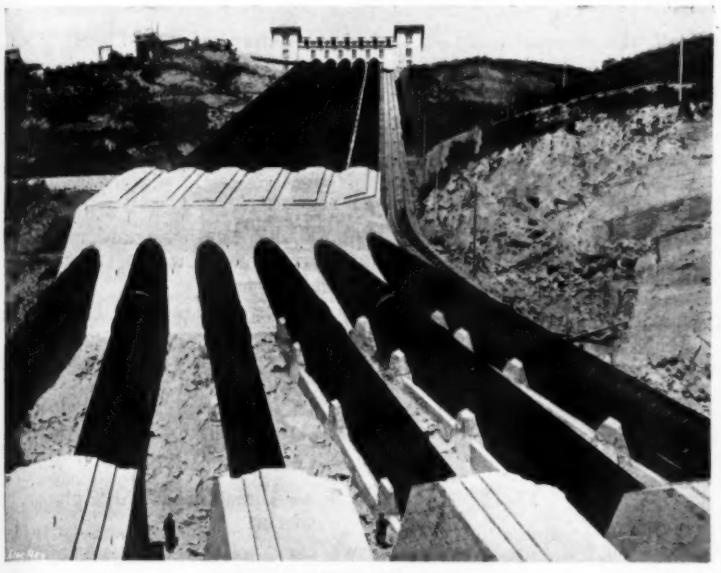
THERE is every indication that the number of delegates at the sixth biennial E.H.P. Conference to be held in Paris next month, under the auspices of the International Electrotechnical Commission, will be greater than in any previous year. The papers to be read cover practically every aspect of large-scale generation and transmission of electricity, and we think manufacturers and supply undertakings in this country will be well advised to make full use of the opportunity thus presented of keeping in touch with the most recent technical developments in heavy electrical engineering.

Vehicle Head-lamps

THE Ministry of Transport has circulated draft regulations which have been framed in an endeavour to mitigate the dangerous nuisance of dazzling road vehicle head lamps. They are to become operative on October 2nd, 1932, but are tentative, and stipulate amongst other things that lamps must not exceed 36 watts each; the beams of lamps larger than 6 watts must be rendered " incapable " of dazzling a person 25 feet distant, or must be deflected downward, or downward and to the left; all lamps of greater power than 6 watts must be deflected when passing an oncoming vehicle; and lamps not exceeding 6 watts in size must produce diffused light. While restricted power has the merit of being enforceable, the fact will remain that a mal-aligned small lamp may be far more objectionable than a correctly focused one of much greater power. Movable lamps can also be made compulsory, of course, but the mobile traffic police will have an unenviable task if they attempt to compel all night drivers to manipulate their lamps to the best convenience of their fellow road users. Nevertheless, if the new regulations do no more than induce motorists to remember that by night, even more than by day, traffic conditions can only remain tolerable in so far as every driver regards himself as the particular guardian of the welfare of all road users in general, they will not have been drafted in vain.

The Cardano Water-power Plant

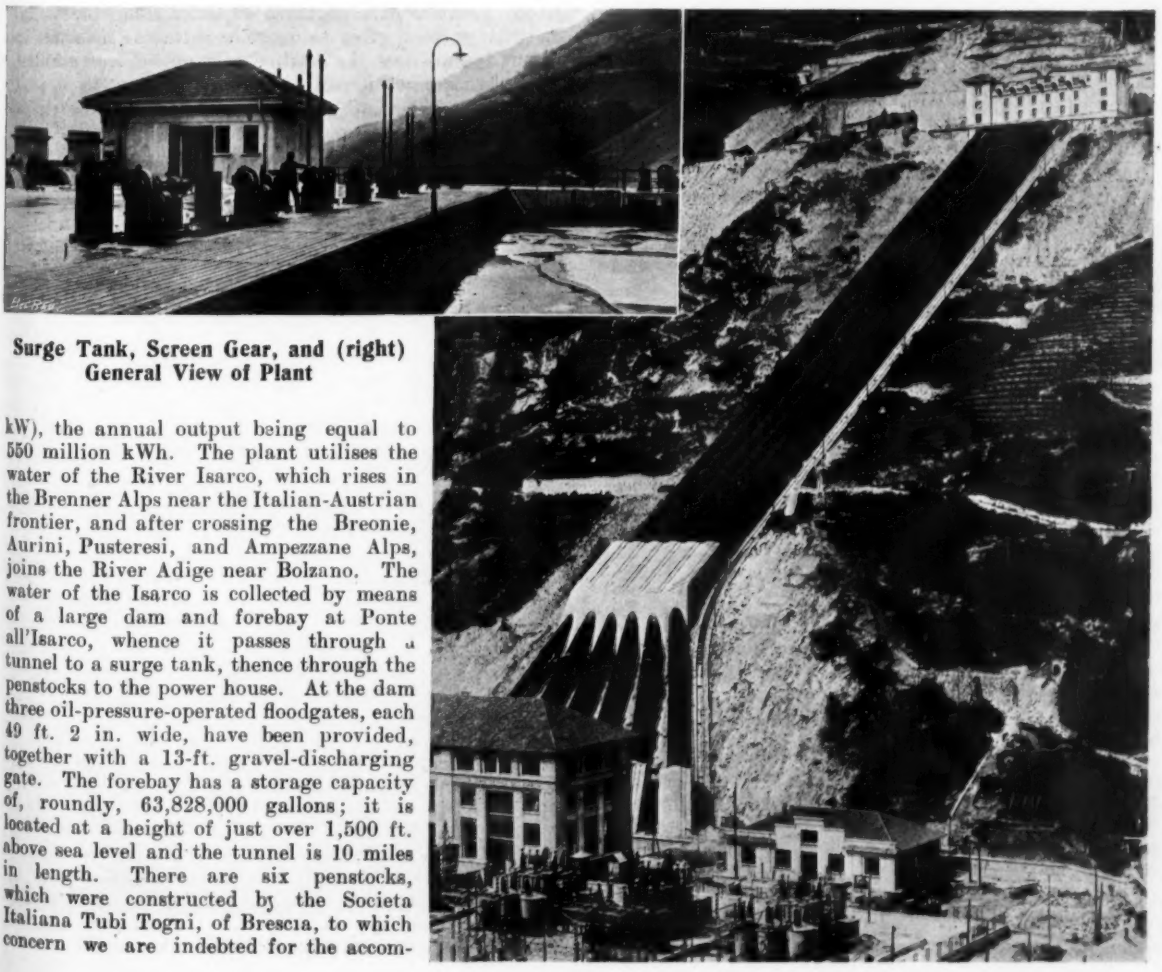
An Italian hydro-electric power station of 200,000 kW installed capacity which is notable for the size of its pipe lines



Penstocks and Pipe Lines

Compare size with men standing in foreground between the pipes

THE Societa Idroelettrica dell'Isarco, of Milan, has recently completed a large hydro-electric power station at Cardano, a village about three miles from Bolzano in Northern Italy. The station works under a total head of about 541 ft. and has at present an installed capacity of 270,000 h.p. (200,000 kW), the annual output being equal to 550 million kWh. The plant utilises the water of the River Isarco, which rises in the Brenner Alps near the Italian-Austrian frontier, and after crossing the Breonie, Aurini, Pusteresi, and Ampezzane Alps, joins the River Adige near Bolzano. The water of the Isarco is collected by means of a large dam and forebay at Ponte all'Isarco, whence it passes through a tunnel to a surge tank, thence through the penstocks to the power house. At the dam three oil-pressure-operated floodgates, each 49 ft. 2 in. wide, have been provided, together with a 13-ft. gravel-discharging gate. The forebay has a storage capacity of, roundly, 63,828,000 gallons; it is located at a height of just over 1,500 ft. above sea level and the tunnel is 10 miles in length. There are six penstocks, which were constructed by the Societa Italiana Tubi Togni, of Brescia, to which concern we are indebted for the accompanying illustrations. Five of the pipes, one for each turbine, are about 1,082 ft. in length and they vary in inside diameter from 9 ft. 2¼ in. down to 6 ft. 2¾ in., the static head being approximately 527 ft. The upper portions of the five pipes are constructed of rivetted steel-plate, while their lower portions consist of banded pipes, *i.e.*, lap-welded and reinforced by rolled seamless rings shrunk on when hot; they are claimed to be at present the largest inside diameter (8 ft. 2 in.) banded pipes in the world. The sixth pipe supplies the water for the turbo-generator set generating power for the operation of the electric trains on the Brenner railway. Five Francis vertical-shaft turbines each develop 45,000 h.p. at 242-250 r.p.m., and were constructed by the Societa Costruzione Meccanica Riva, of Milan; two 500-h.p. Pelton turbines were built to work at 500 r.p.m. by the same company for the supply of the power required for the station services, while three 14,700 h.p. 250-r.p.m. Pelton turbines are used to supply the railway, two of the latter having been built by the Societa De Pretto-Escher Wyss, of Schio, and one by the Societa Franco Tosi, of Legnano. Outdoor transformers step the voltage up to 220,000 V for transmission by a line 146 miles in length (belonging to the Societa Idroelettrica Piemonte) to Cislago, near Milan, where it is stepped down again for distribution through the mains of the Piemonte Co.



Surge Tank, Screen Gear, and (right) General View of Plant

The Volt-Amperes in a Circuit

An Application of the Principle of Symmetrical Components to Balanced Voltage Conditions

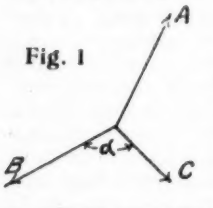
By G. W. STUBBINGS, B.Sc., F.Inst.P., A.M.I.E.E.

WE have considered, in a previous article,* the general problem of resolving unbalanced 3-phase systems into symmetrical components of opposite phase sequence. When both the currents and the voltages in a 3-phase circuit are unbalanced, the power is carried by both the positive and negative sequence components of the current system, combined with the symmetrical voltage components of like phase sequence. It is fairly evident that symmetrical systems of 3-phase currents and voltages of opposite phase sequence give rise to an oscillating value of the power, which has an average value of zero. The components of the power in a 3-phase circuit, carried by the positive and negative sequence currents, can be in the same, or in opposite directions, according to the phase relations of the various components of current and voltage.

Balanced Voltage Systems

Commercial three-phase voltage systems are frequently approximately balanced, and if we neglect such small degrees of unbalancing as occur in practice, the conception of symmetrical components is useful in giving a clearer idea of the notions of power factor and volt-amperes with an unbalanced current system than is readily obtainable otherwise. As we have seen, if the voltage system is balanced, the negative sequence component of an unbalanced current system carries no power, since there is no voltage component of similar phase sequence with which it can combine. The power in such a circuit is therefore carried by the positive sequence currents. As these form a symmetrical system, the power factor of the currents is the cosine of the phase difference between this system and the balanced voltage system. The quantity "total equivalent volt-amperes," obtained by the vector summation of watts and reactive volt-amperes, is evidently the same as the positive sequence volt-amperes.

Fig. 1



Since, with a balanced voltage system, an integration of positive sequence currents can be obtained by a kilo-volt ampere meter of the wattmeter type, it is interesting to inquire if an integration of negative sequence currents can be similarly obtained. In a 3-phase watt-hour meter working on a balanced voltage system the voltages in the two elements are 60 degrees apart in phase. The association of two line currents with these voltages is the same as the association, with a single voltage, of the two currents, with their phase separation diminished by 60 degrees. The meter thus registers the integration of the in-phase component of the positive sequence system. A reactive meter likewise registers the quadrature component of this system. It is not difficult to show that if the voltage circuit connections to a 3-phase watt-hour meter be changed over so that a blue current is associated with a red voltage, and *vice versa*, and the polarity be such that the elements are in opposition with a balanced load, then the registration of a meter so connected will depend upon the magnitude of the negative sequence component, and that a kilo-volt-ampere combination so connected will register negative sequence ampere-hours. As before, the voltage system is assumed to be balanced.

Relation of Symmetrical Components to Total V-A

In fig. 1 we have the vector diagram for an unbalanced 3-phase system of currents where A, B, and C represent the line currents and α is the phase angle of B with respect to C. Defining the system by B, C, and α, we have, by geometry,

$$A^2 = B^2 + C^2 + 2\,BC\cos\alpha \quad \ldots\ldots(1)$$

The magnitude of the positive sequence system P is equal to $1/\sqrt{3}$ times the resultant of B and C retarded 60 degrees in phase. Thus,

$$3\,P^2 = B^2 + C^2 + 2\,BC\cos(\alpha - 60^\circ) \quad \ldots\ldots(2)$$

Similarly, if Q be the magnitude of the negative sequence component,

$$3\,Q^2 = B^2 + C^2 + 2\,BC\cos(\alpha + 60^\circ) \quad \ldots\ldots(3)$$

Therefore

$$3\,(P^2 + Q^2) = 2\,B^2 + 2\,C^2 + 2\,BC\cos\alpha = A^2 + B^2 + C^2 \ldots(4)$$

The sum of the squares of the positive and negative sequence currents is therefore equal to the sum of the squares of the actual line currents.

When the voltage system is balanced, we have seen that the negative sequence currents carry no power, and are, in a literal sense, wattless. The above relation gives a very interesting mathematical analogy between the negative sequence component of an unbalanced current system and the reactive component of a balanced circuit.

The Volt-Amperes in an Unbalanced Three-phase Circuit

We have seen above that, with a balanced voltage system, the total equivalent volt-amperes given by an energy and reactive meter combination is simply the positive sequence volt-amperes. A kilo-volt-ampere demand indicator which is operated by current alone develops a torque proportional to the square of the current in its winding, and a 3-element instrument used in a 3-phase circuit gives an indication proportional to the square root of the sum of the squares of the three line currents. Such an instrument, therefore, takes into account the unbalance of the circuit due to the presence of a negative sequence component, and on this ground gives a more equitable measure of demand than does the wattmeter type of instrument, which ignores the negative sequence component.

We may obtain an idea of the difference in the values of the volt-amperes, computed according to various methods, by evaluating these values for the circuit, the vector diagram of which is shown in fig. 2. If the current in A line is in phase with the corresponding line to neutral voltage, then, considering this voltage to be unity, the arithmetical sum of the volt-amperes is $3 + 2\sqrt{3} = 6.464$. The reactive power is evidently zero, and the value of the watts is $3 + 2\sqrt{3} \times \frac{\sqrt{3}}{2} = 6$. This is the value of the total equivalent volt-amperes, and this is also the value of the positive sequence volt-amperes. The square root of the sum of the squares of the line currents is $\sqrt{15}$ and $\sqrt{3}$ times this value is $\sqrt{45} = 6.7$.

The arithmetical sum of the three line currents is intermediate between the values given by the wattmeter and the current-operated types of instruments. The indication of a wattmeter demand indicator is always less than the arithmetical sum of the line currents, while that of the current-operated instrument is always greater, except when the circuit is balanced, when all three values are equal. Which type gives the closer approximation to the arithmetical sum depends upon the conditions of unbalance in the circuit.

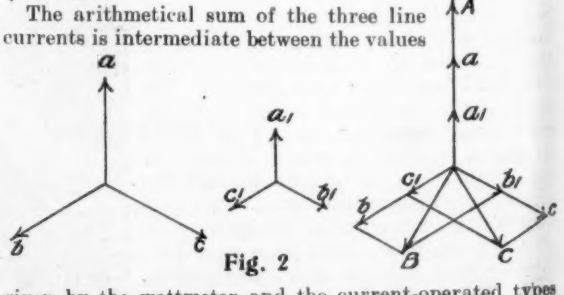


Fig. 2

* Unbalanced Three-phase Circuits, ELEC. REV., May 8th, 1931.

Electricity in Cork

Some Reminiscences of Early Days; the End of a Phase

By R. N. TWEEDY

Mr. H. H. Nalder

ELECTRICAL progress in Ireland is becoming so rapid that it is well to make a few historical records lest they and the people concerned with them should be forgotten.

The Cork Tramways & Lighting Co. took over the Provisional Order of the Cork Corporation in 1898, and later on supplied also the suburban area in the Cork rural district. Except for the beneficial effect of the higher load factor, it is probably true to say that the company would have been much better off without the tramways.

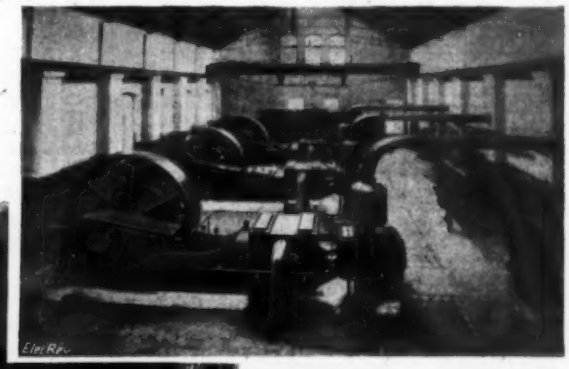
The power station was erected where it still stands in Albert Road; the original plant consisted of three Macintosh and Seymour horizontal tandem steam engines each driving dynamos of 200 kW which were interchangeable for either traction or lighting services. Distribution was effected at 460 and 230 d.c. 3-wire with balances and a floating battery.

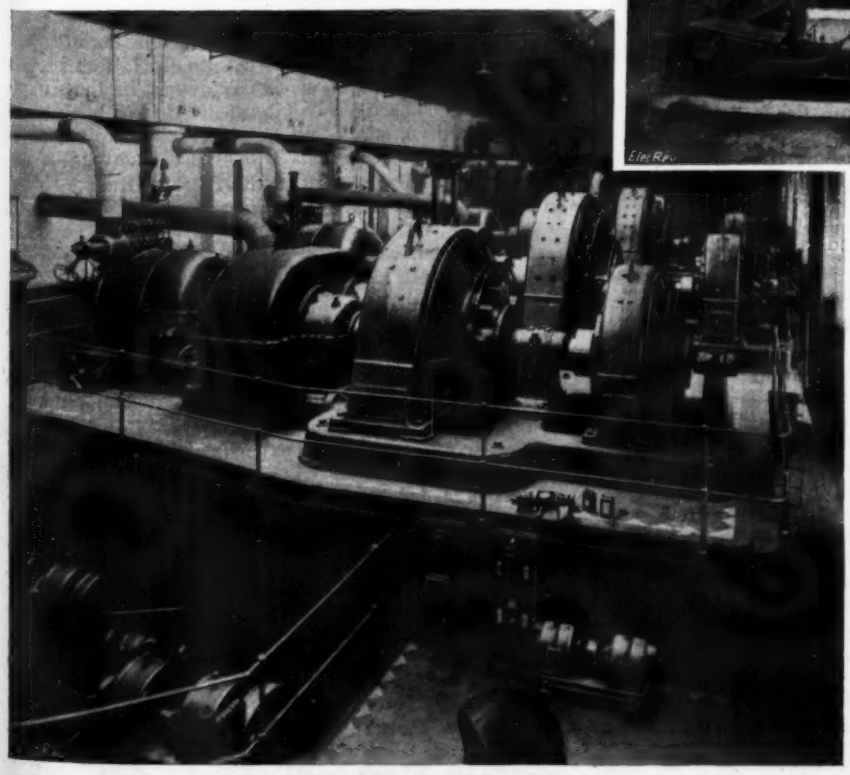
Chas. H. Merz signs, as secretary and engineer, the foreword to the attractively produced brochure issued by the company in 1899. Tables therein show that the average rate per kWh, including the supply of lamps, ranged from 5d. for shop windows to about 1.33d. for basement lighting, and particular emphasis was laid upon the fact that after an average use of two hours per day throughout the year additional kWh would cost only one penny each. For an extra penny per kWh all round the company undertook free-wiring service, including lamp supplies and renewals. The average charge for power was from 1d. to 2d. per horse-power per hour. Motors were supplied free on trial for two months and could be then either bought outright or hired.

At the present time the total capacity of the station is 7,000 kW, and the maximum load is 6,000 kW in addition to the traction load. It contains three B.T.H. Curtis steam turbines (one 2,500 kW and two 2,000 kW) driving, through gearing, two dynamos each, one of which is for use on the City supply, the other being available at times of light load when both lighting and traction can be supplied off the one unit.

In April, 1930, the lighting and power business was purchased by the Electricity Supply Board, and the whole steam station has been relegated to the position of standby to the Shannon hydro-electric supply, delivered through a rotary-convertor sub-station.

Mr. H. H. Nalder, who has hidden himself overlong from the view of the profession outside Cork City, joined the B.T.H. Co. just in time to help in the erection of the Cork station, and was appointed shortly afterwards chief engineer and manager. Like so many pioneers in central station work, he received his technical education from the City and Guilds of London. He then joined Crompton's at Chelmsford, and afterwards went to Siemens at Woolwich. He was closely concerned in the erection of plant in Belfast, Derby, Cardiff, and Ealing stations, being loaned to the last three Corporations to run the plant until the permanent staffs took over. After a very uphill struggle in Cork the forward policy pursued tenaciously by Mr. Nalder put the company into a strong financial position, much to its advantage when it came to negotiating a sale to the Free State Electricity Supply Board.





Cork Power Station, Ancient and Modern

Cork is a bad city for mains, and the note on page 842 indicates how some of the difficulties were overcome.

Mr. Nalder carried out with his own staff all extensions to plant and buildings. He succeeded in persuading Henry Ford & Son to lay up their own power station in favour of a bulk supply, and in 1929 out of 15,599,823 kWh generated not less than 6,805,115 were sold to Messrs. Ford & Son. In that year the coal cost per kWh was 0.32d., which compares well with Dublin at 0.35d., and may be considered an excellent figure for a station with no very modern plant or refinements.

Ozone in Industry

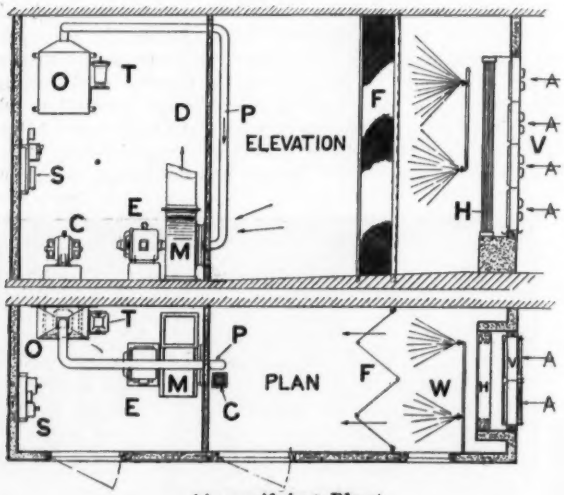
The purification of air and water and the bleaching of oils and fats are among its most important uses

By A. E. WILLIAMS, F.C.S.

FOR many years after its discovery the allotrope of oxygen, ozone, remained little more than a laboratory curiosity until—about thirty years ago—it was applied on an extensive scale to the purification of water-supplies in America; since then it has been successfully used in many other branches of industry.

An important economic factor which favours the use of ozone in industry is the low cost of its manufacture, the initial outlay for the ozone plant representing the only appreciable item of expenditure in connection with its employment. Its chief application in industry is based upon its most important property, that of a powerful oxidising agent. Apparently, the presence of water-vapour is a necessary adjunct to the oxidising power of ozone, for it has been shown that perfectly dry ozone has little, if any, oxidising activity.

Ozone decomposes slowly at 100 deg. C. and more rapidly with increasing temperature, until at about 260 deg. C. it decomposes practically instantaneously.



Air-purifying Plant

Riesenfeld[1] and Schumacher[2] have published interesting theories of the decomposition of ozone. Its decomposition is accelerated by the presence of certain catalysts, *e.g.*, metallic oxides, halogens, &c., and the highest concentration yet attained as a gas is 28 per cent. by weight of oxygen.

Formation of Ozone

Ozone may be produced by several methods, *viz.*, by the electrostatic field; electrolysis; chemical action; ultra-violet rays; incandescent solids; radio-active elements; and by the evaporation of water.

The majority of these methods are of scientific interest only; production by the electrostatic field being the chief method of preparing ozone on a commercial scale.

Industrial ozone plants are always operated by means of high-voltage, single-phase, alternating current, the type of plant used varying widely and generally in accordance with particular requirements. Whilst a description of the various types of ozone plants does not come within the scope of this article, it is necessary in all cases to dry thoroughly the air-supply entering the ozone plant. This is usually accomplished by refrigeration of the air to a little below zero C. which is found to be the most economical working temperature and which gives a dry, dense air very suitable for ozonising. In some cases calcium chloride is employed, either alone or in conjunction with the refrigerating plant.

Air Purification and Ventilation

The use of ozonised air in conjunction with an air-cleaning plant is probably the best means of maintaining a suitable atmosphere in factories. It is not possible to use a concentration of ozone sufficiently high to exhibit any marked germicidal effect. Thus bacteriological action requires a concentration of about 0.5 gm. of ozone per cubic metre, whilst the highest concentration in which breathing is tolerable is about 0.001 gm. per cubic metre. It has been shown by McDonnell[3] that the presence of 0.1 gm. ozone per cubic metre of air considerably shortens the life of normal guinea pigs, largely by inducing pneumonia. In practice the ozone content of the atmosphere in such buildings should not exceed 0.0002 gm. per cubic metre.

One of the many types of ozone plant for air purification manufactured by Ozonair, Ltd., is illustrated herewith. In this apparatus, the system consists of drawing the air-supply from an outside source at A, through a Ventex air filter V. This filter has a viscous surface over which the air is forced to pass in a narrow, sinuous path, during which it is buffeted from side to side. Each time it strikes the viscous-coated side the particles of dirt adhere to the viscous material and are thus trapped.

The air, which emerges from the filter perfectly clean and free from solid matter, is then passed over a heater H, through an atomised water spray W and on to a wet screen F. During this operation the wet screen acts as a humidifier, and, incidentally, the deleterious gases met with in all industrial areas are absorbed. The cleaned air is now passed into the mixing chamber M where it is intermixed wth ozone, and passed by a fan to any point desired. D is the air discharge and G the gallery for dirty water.

Estimation of Ozone

When ozone is passed into a neutral solution of potassium-iodide, iodine is liberated from the latter, in proportion to the amount of ozone present in the sample under test. The liberated iodine is then acidified and titrated with standard sodium-thiosulphate solution.

The equations concerned in the reactions are :—

$$2KI + O_3 + H_2O = 2KOH + I_2 + O_2.$$

$$2Na_2S_2O_3 + I_2 + 2KOH + H_2SO_4 = 2NaHSO_3 + 2NaI + K_2S + H_2S_2O_6.$$

From the above equations it will be seen that :—

$$1 \text{ c.c. of } N/10\ Na_2S_2O_3 = 0.0024 \text{ gm. of } O_3.$$

A suitable quantity of the sample, depending on the amount of O_3 likely to be present, is drawn through the KI solution, then an equivalent of H_2SO_4 is added to the KI solution. The mixture is now titrated with the N/10 thiosulphate. It is usual to express the amount of ozone in grams per cubic metre.

The use of starch-iodide paper (which may be obtained from laboratory furnishers in books, similar to litmus paper) affords a speedy means of ascertaining the *approximate* amount of ozone present, and this method has the advantage of being easily applied by any inexperienced workman.

A number of standard test-papers are prepared by exposing the starch-iodide paper to known amounts of ozone, which colours the paper different shades of blue, corresponding to the strength of ozone present. These standard papers are then carefully preserved in a sealed glass vessel. By comparing the colour of the paper used in the test with the standard paper a rough idea of the proportion of ozone present can be formed.

[1] Riesenfeld, Z. physikal. Chem., 1930, 314.
[2] Schumacher, J. Amer. Chem. Soc., 1930, 2377.
[3] McDonnell, J. Assoc. Off. Agric. Chem., 1930, 13.

Inventions of Salaried Employés

By J. W. THOMAS, LL.B., B.Sc., A.M.I.E.E. (Barrister-at-Law).

IT is chiefly from the research departments or the design and drawing offices of engineering works that most inventions emanate, because engineers and draughtsmen have special facilities for inventing and are able to make use of the materials and plant of their employers. Owing to the closeness of the relationship between the inventors and their employers, it is often debatable whether an invention when made is the property of the employé or of the employer. The general rule is that the inventions of an employé belong to him unless he is paid for inventing. It has been stated in one case that the mere relationship of master and servant gives no right to the employer in the inventions of the servant.

In the absence of any special contract, when a servant makes an invention, even though in his employer's time and with his materials and at his expense, the patent when obtained is the exclusive property of the inventor. In another case it was held that the mere existence of a contract of service did not in itself disqualify an employé from taking out a patent for an invention made by him during his term of service, even though the invention related to subject matters germane to and useful for his employers in their business.

Employers' Rights

There is an exception, however, to this general rule that where it is a fair inference from the circumstances of the case, having regard to the obligations arising from the service and the good faith which is imposed on both sides, the Court will infer an agreement that the employer should have the benefit of the servant's invention. If, for instance, a servant is employed for the express purpose of inventing, his inventions will be the property of the employer. Or, if the employer suggests an idea to a subordinate and leaves it to him to work out the practical details, the fact that the employé exercises skill and inventive ability will not entitle him to claim an interest in the invention.

If an employer has discovered an improved principle and employs engineers to assist him, any accessory improvements which they may make will be the property of the employer. Where there is a duty upon the employé to make the best design he can and to place it at the disposal of his employer, then it is obviously just that the invention should be the property of the employer. In one case an assistant engineer whose duty it was to design the best method of carrying out certain work for his employer discovered, in the course of his employment, a method by which his employer could more effectually carry out his work. For this invention he obtained a patent and claimed to retain the benefit for his own use, but it was held by the Court that the terms of his employment imposed upon him an obligation to produce the best design he could, and he was therefore a trustee of the patent for his employer.

If an employé is engaged in the research department of a large industrial undertaking he will be able to draw so much inspiration from the resources of the department, not only in the technical equipment available, but in the data which has been accumulated over many years, that it is only fair that the employer should be the trustee of the invention when it is made. If, however, an employé is not engaged in research or paid for inventing, but is employed in order to exercise supervisory duties, then if he makes a discovery he is, apart from any specific terms in his contract of employment, the true inventor and the one who has the right to patent the invention and to have it as his own property.

A Classification of Inventions

For the sake of convenience it is usual to divide inventions of employés into three categories:—

(1) Those which are made independently of the employé's duties, and which being outside his normal sphere of activity have no relationship to the undertaking in which he is employed. Such inventions are obviously the property of the inventor, and the employer has no part or lot in them. These inventions are sometimes called "free inventions."

(2) Those which have some relationship to the activities carried on by the employer, or which come within the normal sphere of employment of the inventor. They are not the consequence of any express order by the employer, nor do they result from any normal activities which might be expected from the employé. Opinion differs whether this type of invention should belong to the employer or not. Some people contend that because such inventions have been made during the hours of employment and with the use of the employer's apparatus, or have been inspired by the kind of work provided by the employer, they ought to be his property. It is also argued that the majority of such inventions are improvements of processes or inventions already made, or that the whole practical and industrial organisation in which the inventor works is an indispensable element, and therefore the employer has the right of ownership. On the other hand, it is contended that while it may be true that such inventions have some relationship to the employer's business, and that the inventor has drawn his inspiration from the employer's materials, it does not follow that the invention has been made in the employer's time or that he is responsible for the invention. The employé might argue that he is not paid to invent, and that while he may possibly have obtained the germ of an idea whilst carrying on his employment, he has devoted some of his leisure time to its development and therefore is entitled to the ownership of his invention.

(3) Those types of inventions which are made by employés who are paid to invent. These are usually made by men who are particularly qualified for their inventive faculty or their genius for research. It is not unreasonable that when such employés make inventions the employer should claim the benefit of them, as it is part of their employment to discover new processes and their remuneration is assessed accordingly. As a general rule there is not much difficulty in settling the rights of the employés in such cases.

Inventors' Agreements and Remuneration

It is with regard to the second class that most controversy arises. If an employé is engaged merely to carry out supervisory duties, or to operate and maintain plant, he is obviously not paid to invent and is under no obligation to discover new processes or methods. If he invents anything he is doing something over and above what he is expected to perform by his contract of employment and is therefore reasonably entitled either to all the benefits of the invention or to some recompense in the shape of increased remuneration. The respective rights of employers and employés in such cases may be difficult to define, and all the circumstances must be taken into consideration in each case.

The foregoing considerations have been based on the assumption that no stipulations to the contrary have been made in the contract of service. A growing practice is for employers when engaging technical staffs to insist upon their entering into an agreement whereby the rights in any inventions which they may make shall become the property of the employer. It is not unusual to find in these contracts a clause by which the employé undertakes, without any extra remuneration otherwise than the salary agreed upon, to communicate to the employer all inventions, improvements, or plans made by him during the period of the contract, to transfer to the employer the exclusive ownership in such inventions, and to comply with all formalities which may be necessary for putting the employer into legal possession of those inventions. A contract of this kind

whereby an employé renounces in advance all rights to his inventions will have the force of law unless it is so harsh as to be unenforceable.

Theoretically, of course, an employé can refuse to enter into such a contract, but in practice he cannot as a rule afford to refuse to do so.

Such contracts therefore, unless they have been carefully framed so as to make some provision for recompensing the inventor, may tend to discourage employés from inventing. If an employé having discovered some method useful to his employer is deprived of any fruits of that discovery he will probably not exert himself in any way in the future. A harsh agreement therefore may mean the killing of the goose that lays the golden eggs, or may drive the inventor to use his friends as patentees.

While one recognises the desirability that an employer's interest should be safeguarded and that he should not be hampered by constant claims by his employés to take out patents, it is equally important that inventors should not be discouraged by harsh or unjust treatment. As a general rule some kind of compromise is inevitable, and the provisions of any agreement should be flexible enough to allow the employer to afford some recompense to an employé from whose invention he has subsequently benefited, while at the same time reserving to himself the rights over the invention to which he is entitled.

The Granting of Patents

It should be noted incidentally that if an employé makes an invention, the patent will have to be taken out in his name, either alone or jointly with someone else, and this is so whatever rights the employer may have over the invention when patented. If the employé is in the service of a company, the company being unable to invent anything cannot claim to be the true and first inventor and therefore cannot take out a patent for itself.

While, therefore, an inventor may assign his patent either wholly or partly to another, he cannot assign his right to apply for the patent. The general practice is for the patent to be taken out in the joint names of the inventor and the employer. The fact that an employé has his name attached to a patent gives him a certain amount of prestige and is an asset to him when applying for other positions. Where two persons take out an invention in their joint names, each is, apart from any agreement to the contrary, entitled to use the invention for his own profit, without accounting to the other, but neither can grant a licence to a third party without the other's consent.

Supply Undertakings' Practice

So far as one can ascertain there are not many electricity supply undertakings in this country which require their technical employés to enter into agreements whereby they renounce their rights in advance over their inventions. The present practice appears to be for undertakings to allow their employés to take out patents for themselves if they invent anything, but usually on the assumption that the undertaking will have the use of the patent if desired.

As in many cases, by the general principles of law, an employé who invents something during his employer's time and with his materials will be deemed to be the trustee of the patent for his employer, the latter can if he desires enforce his rights over the patent and therefore there is not much necessity for him to insist upon an agreement being entered into. In any case where an agreement is insisted upon it should give to the employé the right to take out a patent and to utilise it if the employer does not desire to exercise his rights over it.

The question of inventions of salaried employés has become of growing importance in modern industry, and has aroused a great deal of interest not merely in this country but abroad. In 1928 the Advisory Committee of Intellectual Workers set up by the International Labour Office of the League of Nations undertook the study of the salaried inventor and his position in industry, and presented a report which outlined the conditions in twenty of the most important European countries and the United States of America. It is apparent from a study of that report that many efforts have been made in other countries to introduce systems of regulation so as to control the effective ownership of patents.

Collective Agreements

In Germany regulation has been attempted by means of collective agreements between industrial undertakings and employés' associations with a view to defining the rights of both parties and the remuneration to which the inventor is entitled. In Germany a distinction is made between works inventions, which are the result of collaboration amongst a number of employés, and service inventions, which are those made by employés who are engaged for the express purpose of inventing. In the first case the collective agreement assigns the invention to the employer, and the employés are not entitled to any benefit therefrom. In the second case, while again the employer has the rights over the invention, the patent is usually taken out in the name of the employé, and he is entitled to some extra remuneration to be determined by mutual agreement.

The solution of the general question in this country will probably be found in such collective agreements, as it is difficult to ensure effective protection of the inventor by legislation. There is no reason why associations of technical staffs should not enter into agreements with the employers' organisations which will safeguard the rights of both and yet will not discourage employés from inventing. Such agreements are likely to stimulate the development of inventions and to contribute to the progress of industry.

The Contractors' Conference

THE Electrical Contractors' Association has now issued the preliminary programme of its sixth annual conference which is to be held at Eastbourne from June 24th to 26th.

The morning of the first day (Wednesday) will be devoted to a meeting of the Council of the E.C.A. and its allied bodies —N.E.C.T.A., Ltd., and the N.F.E.A. The delegates will arrive during the day, and in the evening there will be a reception by the President (Mr. H. C. Hazel, M.I.E.E.), followed by a dance. The annual general meeting takes place at the Town Hall on the following morning, when time will be provided for a general discussion of matters of Association interest. Later an official welcome to Eastbourne will be accorded by the Mayor (Councillor Lt.-Col. R. V. Gwynne, D.S.O.), the President replying on behalf of the Associations. After the taking of the official photograph and luncheon, the delegates will reassemble at the Town Hall to hear and discuss a paper by the Associations' solicitor, Alderman R. Tweedy-Smith, LL.D., on "The Law Relating to Electrical Contractors and Engineers." The customary smoking concert will be held in the evening at the Town Hall.

Friday, June 26th, opens with the reading of a paper by Mr. L. C. Penwill, the general secretary, on "Fair Trading within the Electrical Industry," and a discussion will follow. The session will conclude with the usual votes of thanks and the installation of the new President (Mr. W. R. Rawlings), who will deliver a brief address. In the afternoon a garden party is to be held at Devonshire Park, and the day will conclude with a ball and supper at Devonshire Park at the invitation of the Mayor.

As in previous years, arrangements will be made for those delegates who desire to remain in Eastbourne for the week-end.

The conference headquarters will be at the Grand Hotel. The programme includes an application form for hotel accommodation and a voucher entitling members to travel by railway at a reduced rate. It is noted that ladies are particularly invited; special arrangements are being made for them during the business sessions.

In its May issue the *Electrical Contractor and Retailer* points out that Eastbourne provides an ideal setting for such a business-social gathering as the E.C.A. Conference. From an electrical point of view, the closest possible co-operation exists between the Corporation Electricity Department and the local sub-branch of the Association, and the Department operates extensive and well-equipped showrooms.

Aldridge of Shanghai

THE news of the death of Mr. T. H. U. Aldridge, M.I.E.E., M.I.Mech.E., Fel. A.I.E.E., which occurred very suddenly on Sunday last, came as a personal shock to those who are immediately within his electrical circle in this country. The loss will be felt no less keenly by the large number of electrical and public men of Shanghai with whom he had such happy and successful relations during the greater part of his professional career. On the return journey by motor from Henley-on-Thames he had a heart attack which was immediately fatal. The interment was to take place at Kensal Green Cemetery yesterday, after a service at St. Mary's, Paddington Green.

Mr. Thomas Henry Unite Aldridge came home to England just about a year ago to make London his permanent headquarters, after 29 years spent with the Shanghai Municipal Electricity Department and the Shanghai Power Company. He gave up the position of vice-president and manager of the Shanghai Power Company in December, 1929, to take up a position here with the American & Foreign Power Company which purchased the Shanghai electricity undertaking from the Municipality for the sum of £10,000,000.

Upon his arrival here, Mr. Aldridge called at the ELECTRICAL REVIEW offices, as had been his custom on his periodical visits home, and we regarded his permanent return as strengthening the body of widely experienced electricity supply engineers and managers. He was then at the prime of life and in the fulness of his powers. As we talked with him we felt that at 57 years of age, with his unique experience, the chances of a still greater career awaited him.

The progress of the Shanghai electricity undertaking makes an almost romantic story; the mention of such figures as ten million pounds sterling may serve to convey a general idea to those knowing little of its small beginning and its wonderful growth; but most of our readers have been made familiar from time to time, through these pages, with the nature of the system and its continuous and rapid expansion as it became the provider of the means for promoting great and successful industrial undertakings.

Mr. Aldridge went out to take charge of the undertaking in March, 1901, as municipal electrical engineer. He was then 27 years of age—for 29 years he remained there. In 1901 when he joined two "foreigners" and 200 Chinese comprised the staff. When he left for Home last year the "foreign" staff had increased to over 300 and the Chinese to over 3,000. In 1901 the plant capacity was only 550 kW; after his 29 years, he left the Riverside station with a capacity of 161,000 kW and a further 50,000 kW coming along. When the municipality sold the Department to the American interests referred to, the sum agreed was twice the actual book value of the plant. But if we dwell in too great detail upon the undertaking we shall be in danger of paying too small a tribute to the man who was its great controlling spirit. Mr. Aldridge had a very quiet and pleasing personality, and the high favour in which he stood with the Chinese community, as well as with the executive staff and the employés generally, found the most cordial expression at the time of his departure for England in February last year. Mr. C. S. Taylor, who succeeded him as

The late Mr. T. H. U. Aldridge

vice-president and general manager of the Shanghai Power Company, referred to his always consistent attention to staff interests, and Mr. Aldridge, in replying, stated that while naturally the interests of the company must come first, interrelated to those interests and forming part of them were the welfare and happiness of the staff.

The I.M.E.A. Programme

THE Convention of the Incorporated Municipal Electrical Association will this year be held at Scarborough from June 15th to 20th, inclusive, with headquarters at the Grand Hotel. With the exception of from 9.15 a.m. to 12 noon on June 16th, when it will be in the Palm Court at the entrance to the Spa Ballroom, the Convention office will be at the Grand Hotel. As usual there will be an exhibition of electrical domestic and other apparatus organised by the Electrical Development Association, which will be open at the Olympia as follows: Tuesday, June 16th, 10 a.m. to 6 p.m., I.M.E.A. only; Wednesday, 10 a.m. to 2.30 p.m., I.M.E.A. only, 2.30 p.m. to 9 p.m., general public; Thursday, 10 a.m. to 2.30 p.m., I.M.E.A. only, 2.30 p.m. to 6 p.m., official visit of the Electrical Association for Women, 6 p.m. to 9 p.m., general public; Friday, 10 a.m. to 9 p.m., general public.

Except for the issue of badges on the first day, the Convention will commence with a reception at the Grand Hotel from 8.15 to 8.45 p.m. by the president, Mr. Arthur J. Fuller, M.I.E.E., borough electrical and consulting engineer, Fulham. After an assembly of the council in an adjoining room, the proceedings of the second day will commence at 10 a.m. in the Spa Ballroom with a civic welcome by the Mayor of Scarborough, Alderman J. W. Butler, J.P. This will be followed by the presidential address by Mr. Fuller, at the conclusion of which the ladies will be invited to meet Mrs. Fuller at the Children's Corner Café at the Spa for coffee. The presidential address will be followed by a paper by Mr. E. E. Hoadley, M.I.E.E., borough electrical engineer, Maidstone, on "The Cost of Home Service by Electricity." At 12.30 p.m. members will assemble at the Spa for the official photograph. In the afternoon there will be the official visit to the exhibition at 2.30 p.m., and at 4.30 p.m. members of A.M.E.E. will hold a meeting at the Grand Hotel. In the evening, 8.15 to 8.45, there will be a reception by the Mayor and Mayoress of Scarborough at the Spa Ballroom.

The first item on the programme for Wednesday will be the reading of a paper at 10 a.m. at the Spa Ballroom by Mr. Isaac Dixon, Liverpool, on "The Assessment of Undertakings in Relation to Local Rates." At 2.15 p.m. there will be a visit to Whitby.

The proceedings will open on Thursday at 10 a.m. at the same meeting place with a paper by Mr. A. Nichols Moore, M.I.E.E., borough electrical and tramways engineer, Newport, Mon., hon. treasurer, I.M.E.A., on "The Future of the Distribution of Electricity." At 2.30 p.m. "The Value of the Lighting Load to Supply Undertakings" will be presented by Mr. C. W. Sully, director, Electric Lamp Manufacturers' Association (Britain), Ltd. The annual dinner will be held at the Grand Hotel, followed by dancing in the Ballroom.

Thursday will also be "Women's Day," for which a special programme has been arranged by the E.A.W.

On Friday, following a meeting of the council at the Spa, the annual general meeting will be held.

Saturday will be devoted to a visit to the electricity works of the Scarborough Corporation.

As in previous years the annual golf competition for the "Dennis" trophy will be held on a local links. The competition is in aid of the I.E.E. benevolent fund, and will be open from Saturday afternoon, June 13th, to 5 p.m. on Thursday, June 18th. Further information about the competition may be obtained from Mr. R. N. Torpy, Tunbridge Wells.

The following firms, etc., will display examples of their products at the exhibition:—

Bastian & Allen, Ltd.
Belling & Co.
Berry's Electric, Ltd.
British Electric Transformer Co., Ltd.
Bulpitt & Sons, Ltd.
Burnley Components, Ltd.
Carron Company
Chesterton, Jones & Co., Ltd.
Credenda Conduits, Co., Ltd.
Domestic Electrification, Ltd.
Dowsing Radiant Heat Co.
Drake & Gorham Wholesale, Ltd.
Edison Swan Electric Co., Ltd.
Electric Fires, Ltd.
E.A.W.
E.D.A.
E.L.M.A.
Falk, Stadelmann & Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Geo. Green & Co.
Hague & McKenzie, Ltd.
L. G. Hawkins & Co., Ltd.
Horstmann Gear Co., Ltd.
Hotpoint Electric Appliance Co., Ltd.
Jackson Electric Stove Co., Ltd.
Archibald Low & Sons, Ltd.
Manor Electric Oven & Fire Co.
Revo Electric Co., Ltd.
A. Reyrolle & Co., Ltd.
Sadia, Ltd.
Santon, Ltd.
Siemens Electric Lamps and Supplies, Ltd.
Scarborough Corporation Electricity Department
J. H. Tucker & Co., Ltd.
Venner Time Switches, Ltd.
Young Osmond & Young
Geo. Bray & Co., Ltd.

A Hospital Installation

Electricity is used extensively in the recently-opened Stuart Memorial section of the Harrow-on-the-Hill Hospital

IMPORTANT extensions (Stuart Memorial) to the Harrow-on-the-Hill Hospital were opened on May 6th by the Duke and Duchess of York. These extensions consist of a new ward block, with living accommodation for the resident medical officer and matron, and administrative offices, an X-ray block and a nurses home. The electrical installation, which has been carried out entirely by Grierson, Ltd., presents several interesting features, and provides for lighting, heating, power, automatic telephones, radio, and bells. Approximately two miles of heavy-gauge screwed conduit and over six miles of association-grade cable have been used for the installation.

For the ward lighting totally enclosed "Harcourt" fittings equipped with 150-W lamps are pipe-suspended from the ceiling, and in addition there is a small bracket fitting over each bed. Each bracket light is controlled by a switch at the side of the bed incorporated in a bronze flush-type combination

The Main Switchgear

switch plate which contains also a bell push, a radio jack-plug socket and a connection for a portable extension light. The main lighting is dimmer controlled in order to reduce the intensity at night. In the nurses' home sitting rooms ceiling-type enclosed fittings are employed. Interesting lighting equipment is to be seen in the X-ray room where tubular bracket appliances are secured to the walls. Each of these consists of an opal-glass cylinder about 14 in. long and 3 in. in diameter carried in two chromium-plated end pieces. The tube is equipped with two 60-W lamps, one at each end.

A special feature of the installation is the "Ziess Pantophos" lighting equipment in the operating theatre. This employs a special two-filament lamp, one filament for 220 V, 150 W, and the other for 12 V 100 W. The larger filament is used normally off the main supply, and in the event of a supply failure the 12-V filament is automatically brought into service by means of a relay switch placed on the wall of the theatre, the supply being taken from an "Exide" 12-V battery. A test switch is also provided beside the relay switch for trying out the equipment. Another interesting item in this room is an illuminated screen for viewing X-ray films. This consists of three opal-glass plates, at the back of which are suitably placed lamps. There is provision at the front of each plate for holding the film, and the three compartments are arranged for separate switching. The apparatus is built into the wall of the theatre, its chromium-plated front being perfectly flush with the finished wall surface.

The whole of the building is heated by the hot-water panel system in connection with which there are two oil-fuel fired boilers. Two ¼-h.p. motors are used for the oil feed to the burners. A 2-h.p. motor also drives a pump for circulating the hot water round the panel-heating system. Perhaps the point of most electrical interest in connection with the hot-water heating system is the system of magnetic valves for controlling the heating, the work in connection with which was carried out in collaboration with Richard Crittall & Co., Ltd. The valves automatically govern the flow of water to the panels and radiators, and are controlled by thermostats. They are fitted in externally arranged pipe chasers all at the ground level, and the thermostats are situated generally one in each room or corridor. There are about 46 thermostats all told, which are set for operation at about 62 deg. F. The valves are of the plunger solenoid type, and operation of the thermostats closes or opens the solenoid circuits. They are supplied from the lighting mains, but the whole represents an entirely separate electrical installation.

In addition to the hot-water system supplementary heating is provided in the operating theatre by four "Dulrae" low-temperature electric heating panels embedded in the plaster-work of the ceiling. The panels are loaded at 400 W each and are hand controlled.

For sterilising purposes there are installed an electrically-heated steam generator and three electric sterilisers or ovens. The boiler is loaded at 20 kW and employs two sets of elements, 12 and 8 kW. The three electric sterilisers, for gloves, bowls and instruments, have loadings of 4, 6, and 3 kW respectively. The whole of the sterilising plant is supplied at 400 V d.c.

The X-ray apparatus, which was presented to the hospital by Kodak, Ltd., and supplied and erected by Newton and Wright, Ltd., presents some interesting electrical features. The apparatus includes one of the makers' "Holway" mono-valve outfits and has an output range up to 100 mA and 120 kV peak. The h.p. transformer is oil insulated, as are also the transformers for heating the rectifying valve filament and the X-ray tube filament. The requisite unidirectional current for the X-ray tube is obtained by connecting a hot-cathode valve in series, thus suppressing one half of the a.c. cycle. The control of the unit is effected from a trolley switchtable and the quality of the radiation is governed by a selector switch operating a range of tappings on the auto-transformer which feeds the primary of the h.p. transformer.

The manipulative apparatus comprises a combined universal X-ray table and upright screening stand of the latest pattern. Provision is also made for tele-radiography at distances up to 6 ft., in order that distortion of the radiographic image may be reduced to the minimum. Stereoscopic radiography has also been provided for. The whole apparatus conforms to the international recommendations for X-ray protection.

Special Equipment in Operating Theatre

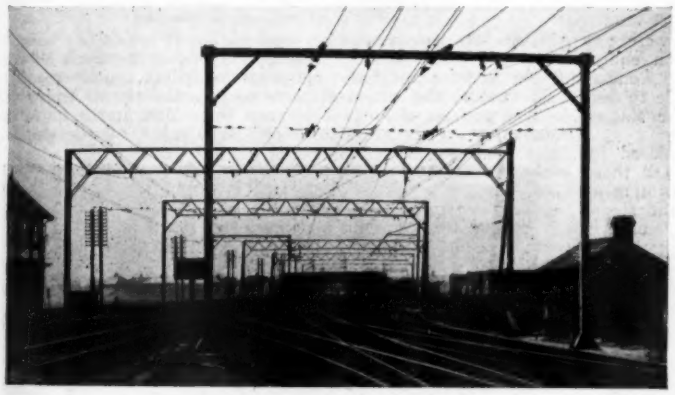
Altrincham Electric Railway

After 80 Years of Steam Working, the Line was Changed Over to Electric Traction last Monday

THE Manchester (South Junction) and Altrincham Railway cannot be termed a main line, but the inauguration of its electrical operation so soon after the publication of the Weir report cannot fail to have the fortunate effect of intensifying public interest in the general question of railway electrification.

A considerably improved service has been effected with a reduction in journey time and an increase of upwards of 25 per cent. in the number of trains per day. Our readers will be acquainted with the salient features of the scheme, which were given in an article published in this journal on January 23rd last; there is, therefore, no need to recapitulate these here, but we give below some information which has since then become available. A view of the 1,500-kW British Thomson-Houston steel-tank mercury-arc rectifier at Old Trafford sub-station is shown on the following page; it is the first to be constructed for 1,500-V railway operation in this country. It is a 12-anode machine with its vacuum chamber fabricated from steel plates by the atomic hydrogen method. The jacket cooling-water supply is thermostatically controlled, and all vacuum seals are made with mercury. The a.c. supply required for ignition and excitation is furnished by a small auxiliary transformer. In order to prevent interference with telephones by ripple in the d.c. voltage wave, a smoothing circuit is employed; this consists of a reactance and four resonant shunts on the d.c. side. The panel in the same sub-station for the remote control of the Timperley rotaries (by means of the Midworth distant repeater system) is also illustrated.

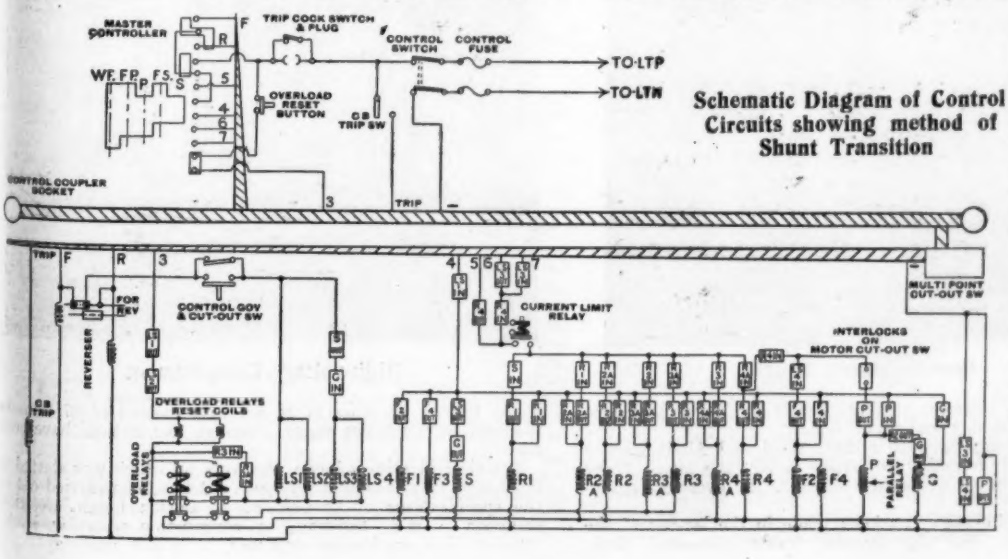
A Six-coach Train at Warwick Junction



Typical Overhead Structure

The structure of the overhead equipment, by Callender's Cable & Construction Co., Ltd., is made up of 2 H-section uprights with two channels bolted back to back between their upper ends. Anchor structures are placed at approximately one-mile intervals and are similar to the standard structure but have an additional cross member and bracing and supporting legs. A typical structure is illustrated herewith. The density of traffic necessitated a sectional area of overhead conductor equivalent to 0.85 sq. in. of copper; this construction is, so far, the heaviest in Europe.

The rolling stock, manufactured by the General Electric Co., Ltd., on the Oerlikon system, comprises 24 57-ton motor coaches, 22 30-ton driving trailer coaches, and 22 30-ton trailer coaches. Each motor coach has two d.c. series-wound 328-h.p. 750-volt motors (connected in series) on each of its two bogies. At 65 m.p.h. the armature makes 1,800 r.p.m. The armature runs in sleeve bearings and the "oil and wool-waste" method of lubrication is used in conjunction with a pneumatically operated injector. With three-coach trains acceleration is 1.43 m.p.h. per sec. Each motor coach develops a tractive effort during acceleration of 23,000 lb.; the approximate tractive effort per coach corresponding to the two ratings of the motors are as follows: hourly, full field 17,600 lb.; weak field 15,000 lb.; continuous, full field, 11,000 lb.; weak field 9,000 lb. Power is collected from the 1,500-V overhead line by means of pantographs pneumatically controlled from the driver's cabin. The action of unlocking the door of the high-voltage compartments makes dead the apparatus. Current passes from the pantograph through a fuse and choke coil (carried, with a condenser-type lightning arrestor, on the roof of the coach), through a roof insulator, and *via* the terminals of an earthing switch, to the main circuit breaker. The contactors are of the electro-pneumatic type. Shunt transition is employed and the motors are arranged for one step of field tapping. Transition is effected in the following manner: Assuming the motors to be in full series with all resistance cut out (see diagram) the current flows through line switches 1 and 2; contactors 4, 3, 2 and 1; motors 1 and 2; contactors S, 4A, 3A, 2A; and motors 3 and 4. The first step in transition is to reinsert the necessary resistance for parallel running by opening contactors 2, 3, 4, 2A, 3A and 4A. Immediately these open contactor G closes and places motors 1 and 2 in parallel connection. The closing of contactor G opens contactor S; contactors LS3 and 4 then close, and the whole equipment is put in parallel. These actions take place in less than one second. The compressors are of the reciprocating type and are mounted beneath the car frame. A 12-kW motor-generator supplies current for control and lighting at 110 volts. Each compartment of the train is provided with four 300-W, 750-V heaters (two in series).

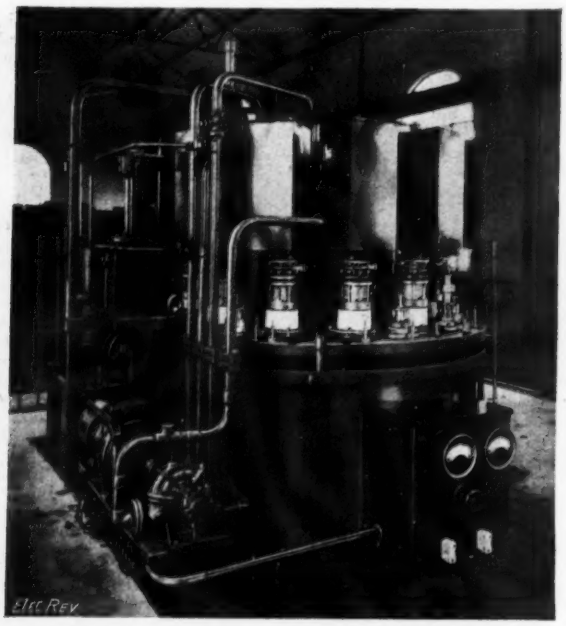


Schematic Diagram of Control Circuits showing method of Shunt Transition

The repair shop at Altrincham has a 25-ton overhead

travelling crane and two electrically-operated bogey traversers. Energy for the machine tools, &c., is supplied by four 1,500/110-V motor generators.

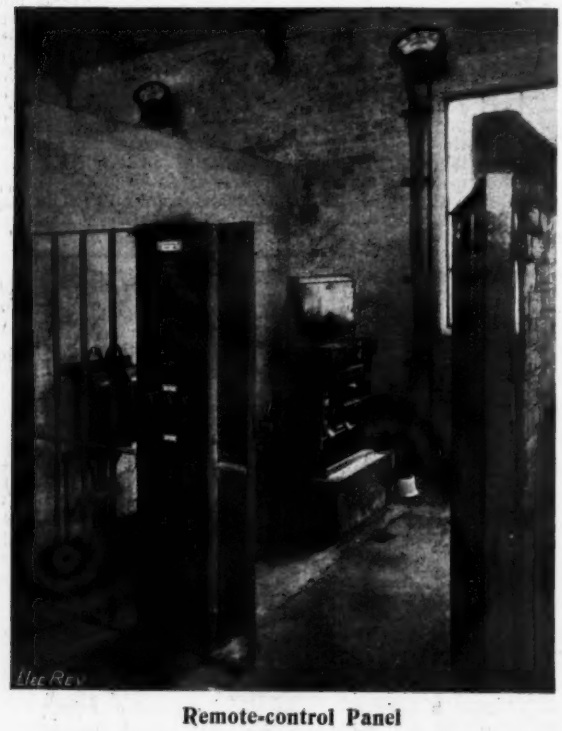
Electrification has necessitated the removal of five signal gantries, together with the east signal cabin at Oxford Road



The 1,500 kW, 1,500-V Rectifier

station. These structures spanned the line, and were not sufficiently high to clear the overhead electrification equipment. By the provision of track circuiting at the London Road end of Oxford Road station it has been possible to deal with the operation of all points and signals at the station from the west cabin.

The signal gantries referred to have been replaced by separate posts fixed on each side of the viaduct. In those positions, however, the overhead electrification equipment considerably interferes with the drivers' sight of the signal arms, and, in consequence, Adlake Corning-Lebby electric



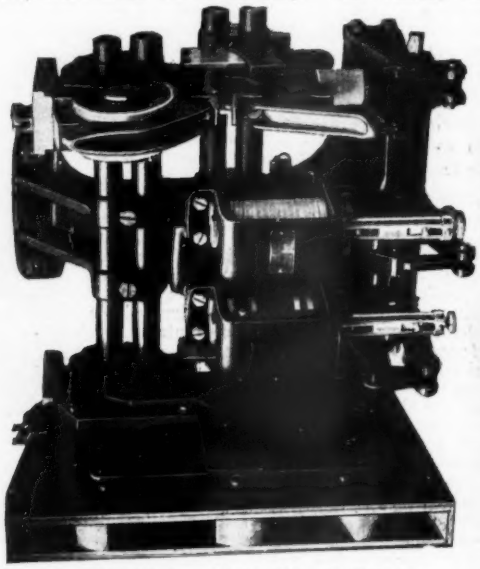
Remote-control Panel

lamps, with an intensity of about 20,000 c.p., have been provided to serve as day and night signals.

At various points between Oxford Road and Altrincham it has been found necessary to alter either the structure or position of a number of signals, owing to the overhead equipment.

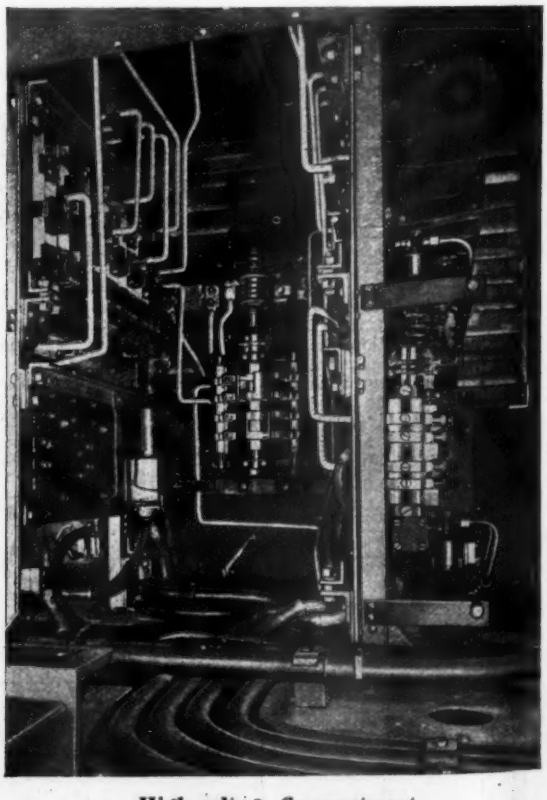
At Sale, an alteration has been made in the lay-out of the permanent way, and the ground frame dispensed with. Track circuits have been provided on the up and down lines, as well as fouling track circuits in connection with the up siding. The points leading into and out of this siding are now operated electrically by B.P. Co.'s 30-volt quick-acting d.c. machines.

On Monday last a Sunday service of electric trains was put into operation and, apart from a slight delay in the morning due to the necessity of adjustments to one of the motors, was carried out successfully. The Sunday service



A 1,500-V d.c. Main Circuit Breaker

under the new conditions provides for 44 trains per hour, as against 38 with steam. The quadrupling of the track between Old Trafford and Sale represents a distinct improvement, as it enables the non-stop trains to pass the slower trains and thus perform the whole journey from Manchester to Altrincham in a quarter of an hour; time taken by the stopping



High-voltage Compartment

trains to run 8¾ miles is 24 minutes, instead of 27 minutes required by the steam trains, although two stations have been added.

The electrification scheme, the work on which was started in February, 1929, has cost £500,000. It has been carried out to the specifications of Lt.-Col. F. A. Cortez Leigh, electrical engineer, L.M.S. Railway, in conjunction with Mr. K. N. Gresley, chief mechanical engineer, L. & N.E. Railway.

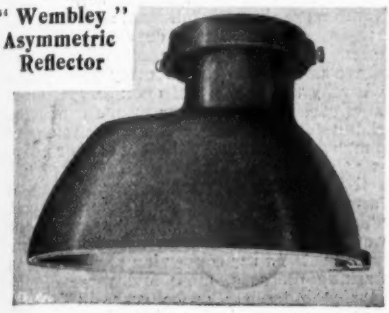
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Street-lighting Fitting

The "Wembley" asymmetric reflector recently introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, is elliptical, of the open type, and is constructed with a single piece of silvered glass. The containing body is of cast-iron and hence robust. The reflector is designed to direct the light up and down and across the street in such a way as to increase materially the illumination at the point midway between standards where the intensity is very often of a low order. The lantern requires to be rigidly attached to the supporting brackets in order that the elliptical field of light shall be of fixed limits. It is claimed that the unit entails practically no maintenance, and that cleaning costs are reduced to practically nil owing to the exterior of the body and the interior of the reflector being smooth. The fittings weighs 10¼ lb.; it is 10¼ in. long, 8 in. high and 8 in. wide, and it is designed for relatively low mounting heights. It is supplied with b.c. or E.s. lampholders, and will accommodate 60- to 150-watt lamps. The standard tapping is ¼-in. gas thread.

"Wembley" Asymmetric Reflector



Independent-supply Turbo Set

The "Brush-Falcon" geared turbo-generator set recently produced by the BRUSH ELECTRICAL ENGINEERING CO., LTD., Falcon Works, Loughborough, has been designed particularly to meet the requirements of mill owners and others who require steam for process work, and who must therefore have boiler plant, often of considerable capacity. The turbine uses steam at 150 to 200 lb. per sq. in. and either exhausts completely to the process mains, or exhausts part of the steam in this way and uses the remainder in a low-pressure section, exhausting to a condenser. It is a straight-forward impulse-reaction machine and is available in sizes from 750 to 2,000 kW. It can be supplied as a "straight" condensing or as a "pass-out" turbine. The most important technical feature is the arrangement whereby the stationary blading is carried on an inner cylinder suspended from the main casing on radial pins, in such fashion that although always maintaining concentricity with the centre line of the turbine, it is free to expand and contract independently of the main casing in sympathy with changes in the temperature. The steam distribution throughout the machine tends under all changing conditions to maintain the mean temperature of the stationary blading at a slightly higher level than that of the rotating elements, carrying the moving blades, so that the risk of rubbing between the stationary and moving blades is reduced to a minimum. The admission of steam to the turbine is controlled by main and auxiliary valves operated through oil relays controlled by the governor in such a way that the pressure is continuously under governor control. Where the turbine is used for passing-out steam for process work an auxiliary governor is provided, so that the turbine maintains a constant speed under changing conditions of load and with varying demands on steam for process work. All the controls are centralised and the plant is compact.

A Thermally Operated Switch

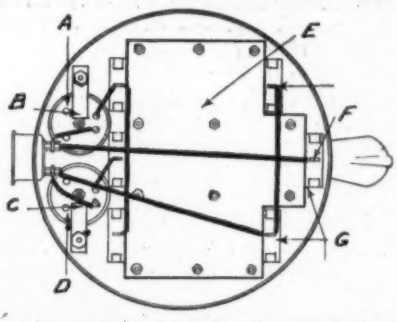
An invention of Mr. R. COLLIER, 1, Elm Park Road, South Norwood, S.E.25, provides a very quick-acting switch of the thermally-operated type, the principle of which is due to the effect of temperature variations on the ferromagnetic material which may have a negligible coefficient of thermal expansion. "Invar" alloy of nickel steel may be used for this purpose, but most ferromagnetics will suit the purpose of this invention. As a two-way thermally-operated flasher the apparatus employs a permanent bar magnet mounted on an insulated base, lying adjacent to which is a springy strip of invar steel alloy secured firmly at one end by a brass block; the other end is free and has a platinum or other rivet sunk into each side. Mounted in line with each rivet, at each side, is an adjustable screw, also preferably platinum tipped. The strip is wound with a coil of higher resistance than the circuit to be controlled, and is sprung away from the magnet, but is attracted to the latter at normal temperatures. The element is in series with one circuit on one side, and when the temperature of the armature is raised to a point approaching that at which it becomes non-magnetic, the armature flies away from the magnet to the opposite stop and short-circuits the heating element. At the same time it closes the second circuit and the armature begins to cool, eventually to be attracted back again to the magnet, and so on. It is claimed that the make-and-break are quicker than are possible with bi-metal strip. If still higher speeds of operation are required there may be employed an armature of some springy diamagnetic material, with the winding itself used as the ferromagnetic part of the armature.

Woodworking Machines

The following notes concern some electrically-driven woodworking machines recently introduced by WADKIN & CO., Leicester. Model "C.F." sawing machine is designed to supersede the pendulum type of saw by cross cutting, not only faster, but more accurately. It requires no overhead structure and has a self-contained electrical drive. The unique design of the saw carriage allows the machine to be operated in smaller floor space than the cross-cut machine. Another sawing machine is the "A.W." 12-in. electric model, which has an exceptionally large capacity for its size. It will admit 16 in. between the saw and the fence, and will saw up to 3 in. deep. The correct speed is obtained from a built-in motor driving through the medium of silent gearing running in an oil bath gear case. On the "P.K." electric canting spindle dimension saw any type of cut can be made with perfect accuracy. The outstanding feature is that compound angular cuts can be made with the table always horizontal, as the saw spindle cants and not the table.

An Automatic Kettle

The new "Dolphin" automatic safety kettle introduced by DOMESTIC ELECTRIFICATION, LTD., Townsend House, Greycoat Place, Westminster, S.W.1, is fitted with two automatic controls. One cuts out approximately three-quarters of the element when the kettle boils, thus saving current and avoiding boiling over, but leaving sufficient loading to keep the water simmering. Should the kettle then be left to boil dry, *i.e.*, after about 6 hours, the second control would cut off the remaining element and save the kettle from damage. The thermostat employed is the Klixon," employing a bi-metal disk. The accompanying illustration depicts the robust construction and the disposition of the elements, &c. Other features include: wide base for quick boiling; wide spout for filling; wide lid for easy cleaning; level gauge; heat-insulated feet. The kettle is supplied in polished-copper or nickel-plated finishes. The total loading is 950 W., and the capacity is three pints.



Construction of "Dolphin" Kettle

A and D, thermostats; B and C, thermostat clamps; E, element clamping plate; F, nickel connections; G, elements.

Flashlight Equipment

CIVIL SERVICE SUPPLY ASSOCIATION, LTD., 425, Strand, W.C.2, is the sole distributing agent in this country for the "Sashalite," a new flashlight bulb for photography. This consists of a sealed glass bulb containing metal foil and oxygen gas. The passage of a small current, as from a pocket-torch battery, gives rise to the immediate ignition and consumption of the foil, resulting in an intense soft light for about one-seventy-fifth of a second. The operation is silent, no fumes are given off, and, of course, the bulb cannot be used a second time. A reflector unit, with either an 11-in. or a 16-in. parabolic, polished-aluminium reflector, has been specially designed for use with the "Sashalite." The body is of black moulded material, and the handle has a comfortable grip. A cluster fitting for up to three bulbs can be used with the large reflector. A telescopic folding stand, up to 7 ft., is available for use with the reflector unit.

"Sashalite" Reflector Unit

D

The Societies and their Doings

Director automatic switching—A new power station—England's largest frequency changer

London's Automatic Telephone System

A GENERAL account of the system adopted for the London area, rather than circuit details, is the object of the paper submitted by Messrs. M. G. HOLMES and L. F. SALTRE to the London Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS. In a large area, such as London, in which a very large proportion of the calls are completed *via* junctions between exchanges, it was necessary that a system in which the junction system was not inflexibly associated with a subscriber's numbering scheme should be adopted. The Western Electric panel system, which is working at New York, provides the requisite flexibility, but the Strowger step-by-step director system was adopted because of its lower capital and maintenance costs. The primary difference to the subscriber is that in the former 3 letters and 4 numerical digits are dialled, whilst in the latter only 4 or 5 numerical digits are necessary.

For routing junction traffic between exchanges under the manual system, in order to obviate the necessity for a group of junctions from every exchange to every other in the London area, certain exchanges were selected as junction-lending centres. It was necessary, in order to complete certain calls, to borrow junctions from two exchanges other than the two terminal ones, the transmission losses being in some cases unsatisfactory. The idea of a tandem exchange to act as a centre for junction-lending purposes was conceived; the introduction of the automatic system was a convenient opportunity for its inauguration and it was designed to work by means of automatic switches. A central point to which heavy-gauge conductor cables, loaded and unloaded, were laid was thus made available for systematic control of junction traffic routing, the "director" apparatus giving flexibility by translating the letter digits dialled by the subscriber into other digits, so that maximum economy in switching and line plant is effected.

The system of maintenance adopted is periodic testing by means of routiners, the tests made simulating actual calls in principle, but imposing more severe conditions, so that faults are anticipated instead of being allowed to develop later.

Since the commencement of the programme of the conversion, endeavours have been made continuously to devise a scheme of working whereby the number of operators involved in a call from a manual exchange subscriber to one connected to an automatic exchange can be reduced, and a system of key-sending from the manual exchange by the use of four voice frequency currents is being installed in London.

Development is in the direction of minimising the amount and value of the apparatus actually held during a call. Economies in line plant will be effected by extension of the tandem system of working to minor areas, and sub-tandem exchanges are being installed. As the conversion of the London area to automatic working proceeds, more and more of the semi-automatic plant at the tandem exchanges will become spare, and the idea has been mooted of working large groups of junctions from provincial centres *via* this exchange, thus enabling still more calls to be completed by auto switches.

The Deptford (West) Electricity Generating Station

IN their paper outlining the principles that governed the design of the Deptford (West) plant of the London Power Co., Ltd., Messrs. C. S. BERRY, H. P. GAZE, and C. E. H. VERITY explained to the INSTITUTION OF CIVIL ENGINEERS that it was intended to carry the base load of the company's system pending the completion of the larger base-load station now being built at Battersea. The steam pressure of 375 lb. per sq. in. and temperature of 780 deg. F. were sufficiently high to realise an economical heat balance and yet enabled standard materials to be used. For flexibility the first two generating sets installed were of 25,000 kW (m.c.r.) each, followed by two of 35,000 kW.

Eight boilers were rated at 75,000 to 90,000 lb. per hour and the second four at from 100,000 to 130,000 lb.; with the exception of the double-ended ones at Barton, they are the largest so far ordered in this country for stoker firing. The standard compartment-type chain grate stokers burn a mixture of low-grade coal and 20 per cent. of coke breeze having a calorific value of 9,000 B.th.u. per lb. Luloff-type water walls are provided on the sides and rear of each furnace with clinker line water boxes; two boilers are also provided with water-cooled arches. Two of the 75,000-lb. boilers are equipped with retort stokers.

The turbines of the 25,000-kilowatt sets are of the Curtis impulse type, with steam extraction points at the fifth and eighth of the eleven l.p. stages. The usual two-row first wheel has been replaced by a single-row wheel of similar diameter followed by six single-row stages of uniform diameter. The two 35,000-kilowatt sets are of the Rateau impulse type, the l.p. stages being arranged on the Baumann duplex multi-exhaust principle. The 25,000-kilowatt alternator stator frames are of the fabricated type, consisting of a number of cast-iron rings assembled together with longitudinal steel bars inside and out, wound with two parallel circuits, a special feature being the alternation of the relative positions of individual strands of the conductors in successive slots, with resulting improvement in the electrical conditions. Cascade excitation is provided and the pressure at the alternator terminals is 6,600 volts, coupled directly to the unit step-up transformers which deliver to the busbars at a pressure of 22,000 volts. The 35,000-kilowatt alternator stators are of standard cast-iron box construction with silicon-iron core-punchings.

The supply to the Southern Railway from the original Deptford (East) station has a frequency of 25-cycles, and for the purpose of providing an alternative supply for that station and of making a proportion of its plant capacity equally available on the interconnected 50-cycle system, a large-capacity frequency-changer has been installed. It consists of two synchronous alternators directly-coupled rigidly and running at a speed of 500 r.p.m. The 50-cycle end is wound for 6.6 kV and is supplied through step-down transformers from the 22-kV main busbars, and the 25-cycle end is supplied direct from the 11-kV busbars in the (East) station. Each alternator has a normal capacity of 30,000 kilowatts at 0.9 power factor, with a ½-hour rating of 60,000 kilowatts, and the set will transmit safely a maximum load of 100,000 kilowatts at unity power factor for a period of five minutes. The machine has an exceptionally high pull-out torque and operating stability. It is started by a 6,600-volt induction motor supplied from the 50-cycle busbars through a separate transformer; of the slip-ring type, the rotor is overhung and rigidly bolted to the main shaft. The excitation system is located at the 25-cycle end and consists of two main exciters, one for each machine, with an auxiliary exciter on the main shaft for the fields of the two exciters. Jacking oil pumps are provided for each bearing to float the rotor journals in order to reduce the starting torque. Motor-driven barring gear is also provided to rotate the set at about 1 r.p.m. for inspection and also to assist in starting. The set has four main bearings with forced lubrication. The rotating parts weigh about 150 tons, the weight of the whole machine being 355 tons. The set can be run up from rest and synchronised on both sets of busbars within about 7 minutes. The guaranteed overall efficiency is 94.7 per cent. at full load. The set has been run regularly at loads rapidly fluctuating between 5,000 and 30,000 kilowatts and the control of excitation and power factor has been entirely satisfactory.

The main transformers, stepping up from 6.6 to 22 kV, consist of two banks each of 33,000 kVA and two of 43,750 kVA capacity, connected direct by single-core cables to the terminals of the alternators and controlled on the 22-kV side. Each bank consists of three single-phase core-type forced oil cooled transformers, the windings being arranged delta/star with the neutral of the 22-kV secondary brought out.

The main switchgear is designed for a final capacity, including the frequency-changer, of 220,000 kilowatts, connected through the 22-kV network to three other stations having a present aggregate capacity of about 300,000 kilowatts. The 22-kV switchgear is of the "cellular" type in complete duplicate. Each oil circuit-breaker has a rupturing capacity of 1,000,000 kVA and is of the semi-"explosion pot" type, there being two upward breaks in series per phase, motor controlled and spring operated.

For the station service supplies at 440 volts a.c. there are two sets of busbars normally supplied from transformers and alternators, respectively, which can be coupled in emergency.

The station was first put into service in 1929, but the maximum load has not exceeded 76,000 kilowatts. The performance curves tend towards a figure for overall thermal efficiency of 25 per cent. per kWh of output and 25.6 per cent. per kWh generated, m.c.r. Excepting minor troubles the plant has operated satisfactorily.

For the portion already completed, which includes river works, jetty-equipment, and switch-house building adequate for the final installed capacity, the total cost per kilowatt installed is £18.72; the corresponding cost per kilowatt excluding land is £17.64. For the future installed capacity of 195,000 kilowatts about 60 per cent. of the plant is already on order and the final cost will be £15.84 per kilowatt installed. It may also be considered reasonable to exclude the cost of the frequency-changer, on which basis the final cost would be £15.4; excluding land, £14.7 per kilowatt.

A third 35,000-kilowatt turbo-alternator, with condensing and auxiliary plant and step-up transformers, and an additional 2,500-kVA house service transformer with complementary switchgear, are under construction. The additional boiler plant will consist of four 160/200,000 lb. per hour vertical bent-tube six-drum boilers with water walls, fin-tube horizontal economisers and plate type air heaters, equipped with retort stokers, with water walls at sides and rear protected by cast-iron blocks. Flue-gas washing plant will be installed and effluent-treatment plant, which will, in due course, be extended so as to provide for the whole plant.

The Witton H.V. Works and Laboratory

The new factory built for the production of switchgear for voltages up to 220 kV and transformers up to 100,000 kVA at 132 kV is busily engaged in association with a liberally-equipped million-volt testing and research laboratory

APPRECIATING the fact that the manufacture of extra-high-voltage transformers and switchgear demands facilities which are not easily obtainable by the adaptation or extension of existing premises, the General Electric Co., Ltd., has, in conformity with its usual policy of providing separate factories for its various classes of products, built an entirely self-contained department devoted solely to the manufacture, routine testing, and comprehensive investigation of e.h.v. equipment and associated phenomena.

New High-voltage Transformer Shop

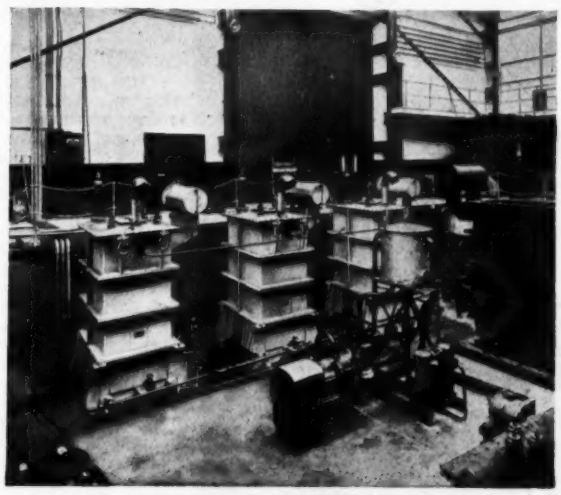
Contracts which the new works are at present completing include switchgear for the British national interlinking grid transmission system, involving the construction of eighty 1,500,000-kVA, 132-kV, outdoor, 3-phase oil circuit breakers, together with 132-kV rotary-type isolating links with complete electrical interlocking.

Complete outdoor substation equipments for voltages ranging up to 66 kV for transmission schemes in Palestine, New Zealand, &c. Pole-mounting high-voltage air-break switchgear and transformers for rural electrification schemes in S.E. Yorkshire and the Worksop district. Large metal-clad switchboards for voltages of 22 and 33 kV, with breaking capacities up to 1,500,000 kVA, for the Sheffield Corporation, the London Power Co., and the North Metropolitan Electric Power Co. Transformer orders include six 30,000-kVA, 3-phase, units for the Central Electricity Board suitable for a primary voltage of 132 kV; a number for Birmingham Corporation totalling over 100,000 kVA in capacity, of which four are of 12,000 kVA and thirteen of 4,000 kVA; and several large units totalling approximately 40,000 kVA in capacity for export to Palestine; also for power schemes in New Zealand, transformer contracts include many units of 5,500 kVA at 63 kV and of 1,500 kVA at 110 kV, apart from the normal sizes in routine production.

A visit to Witton last week revealed the new works to be a lofty well-lighted single-storey building covering an area of approximately 110,000 sq. ft., thus being very nearly as large as the older switchgear works situated alongside. The drawing and other offices are grouped at one end, and stores transversely east and west to the main shops have direct access to all departments, the whole layout causing materials to flow regularly from north to south. The works proper is divided into six bays, north and south, each being 350 ft. in length. A boiler plant in an annexe supplies steam at 165 lb. per sq. in. for the drying rooms, compound melting plant, vacuum impregnating plant, and various calorifiers; oil-fired water heaters are also installed for warming the building. One bay is devoted to the storage of tanks for oil circuit breakers, transformers, &c., while a number of cubicles are arranged for the various welding operations required for structural steelwork used in this class of equipment. The next bay is equipped with modern machine-tools; individual electric drives with push-button control are employed for these machines which chiefly comprise boring, planing, and cutting tools. Overhead travelling cranes, each of 5 tons lifting capacity, are provided in these bays.

The third bay, 60 ft. wide and 30 ft. 6in. to the crane rails, is employed for the erection of large switchgear; the capacity of the crane is 15 tons. The remaining three bays, constituting the major part of the works, are devoted to the manufacture of transformers, the largest bay being 350 ft. long, 60 ft. wide and 30 ft. 6 in. in height to the crane rails; the equipment includes two 30-ton cranes both of which can operate simultaneously as a single unit. On the east side of this bay is a bay 60 ft. wide, split up into two groups each 30 ft. wide, in which the winding of transformer coils is carried out.

This section is equipped with large lathes capable of accommodating coils 9 ft. long and up to 6 ft. diameter, also a battery of pedestal machines suitable for winding crossover coils, and batteries of small high-voltage coil-winding machines mounted on the benches. Finally, on the west of the central transformer bay is a further 30-ft. bay in which the small transformers are assembled; it is equipped with a 5-ton crane. At the south end of these bays are situated seven steam-heated ovens, vacuum impregnating plant, oil storage tanks, oil treatment apparatus, and the test departments. Of the seven ovens, four are capable of stoving the largest transformers built in the works; the doors are fireproof, so designed that the temperature on the outside is practically atmospheric. An important point is that the doors will open from the inside as well as from the outside. Smaller ovens are provided for drying coils. Recording thermometers are installed in all the ovens. Oil is stored in eight tanks each of 3,000 gallons capacity, the electrical pumping equipment being capable of dealing with 5,000 gallons of oil per hour; oil cleaning and fitering plant is also provided.



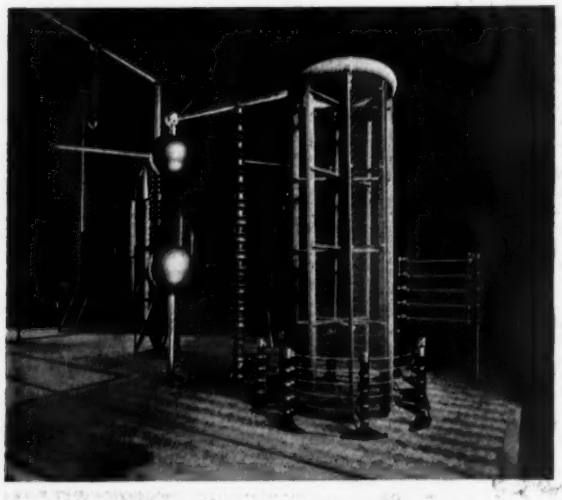
Transformers for New Zealand in Test Pit

The provision for testing transformers is comprehensive; the pit is 10 ft. deep, while the necessary generators, transformers, and control gear are immediately adjacent, and render it possible for full-load tests to be made on units

Metal-clad 22-kV Million-kVA Switchboard for London Power Co.

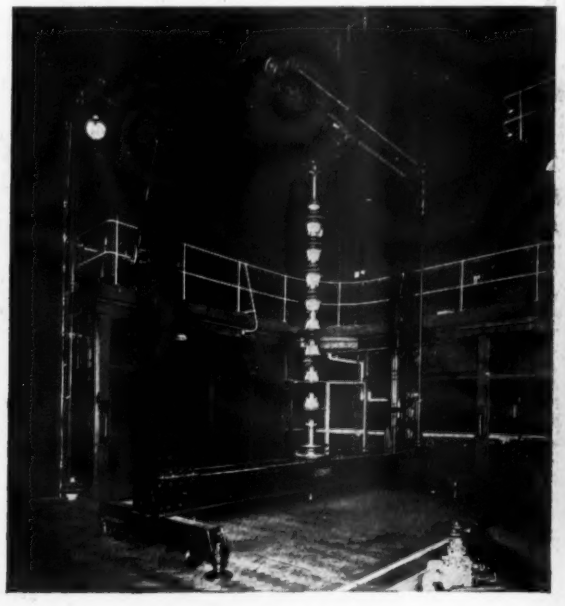
up to 30,000 kVA. For over-potential tests, a 2,500-kVA 150-cycle generator has been installed, and the switchgear and all leads to the machines are totally enclosed.

Adjacent to the works' testing pit is the million-volt laboratory which was inspected after luncheon at the Magnet Club, at which Dr. A. H. Railing presided. Its area is over 5,000 sq. ft., and its height 42 ft. Two large roller shutters provide access to the laboratory across which a standard-gauge railway line runs to enable gear to be received from the switchgear and transformer bays on either side, a 10-ton crane forming part of the equipment. The testing area is screened from the passageways, and entry can only be obtained through a wicket gate which is interlocked with the main circuit breaker. There is a high observation gallery, and a lower one accommodates the desk-type control board. Power is obtained from the transformer shop testing machines previously referred to. The walls are dead black without windows. The principal items of equipment were explained by Dr. C. C. Garrard and their functions demonstrated.

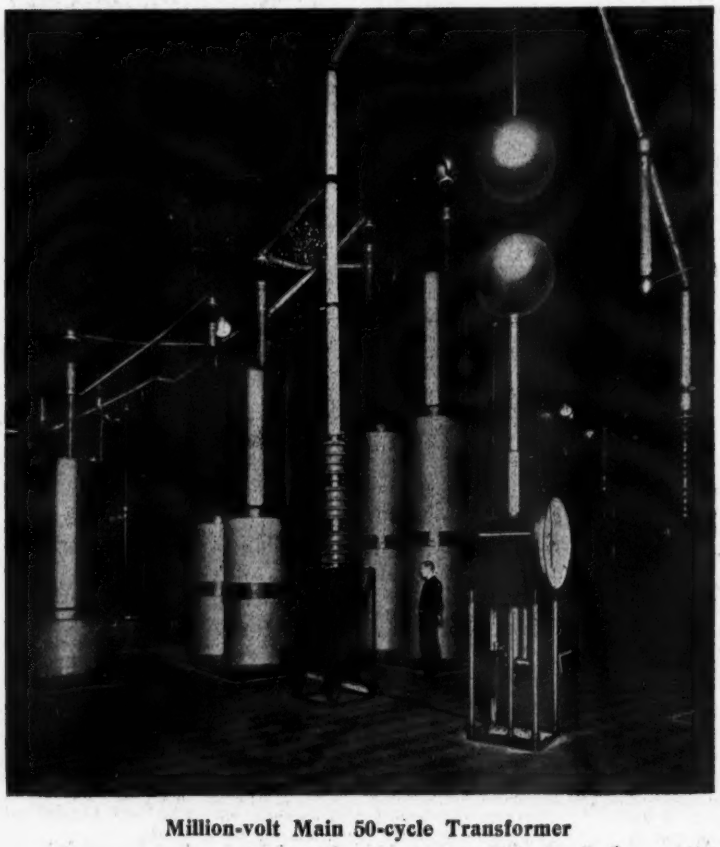


High-frequency Tesla Generator

The 50-cycle pressure-testing transformer has an input pressure of 8,000 V and cascade outputs of 333/666/1,000 kV, the three tanks being insulated from earth for 167, 500, and 833 kV, respectively. This arrangement is the subject of the Dessauer patent, the British rights of which are held by Messrs. Ferranti, Ltd. The object is mainly to avoid the use of very-high-voltage bushings, to reduce the voltage between windings, and between windings and the core and tanks of the individual transformers. Each transformer has a normal h.p. voltage of 250 kV, thus giving 750 kV with the three in cascade. The insulation is such that they will withstand with safety a voltage 33⅓ per cent. greater than this, so that a total of a million volts may be obtained. Three transformers are insulated in various degrees from earth by standing on massive insulating cylinders. The mid point of each winding is connected to the insulated tanks; thus under these conditions the individual transformer bushings are only subjected to a voltage of 167 kV, and can therefore be relatively smaller and less costly. Likewise, as the three transformers are precisely alike, they constitute spares for each other in the event of accident to one of them. The windings are auto-connected, tappings from each lower transformer exciting the one next higher to it. Equalising windings are provided which result in improved regulation and lower impedance. The whole bank is capable of giving an output of 100 kVA for two hours and the impedance of the entire combination, based on that load, is 6.75 per cent., which is low for such a voltage, and thus a large energy output is assured.



Stress Testing Machine



Million-volt Main 50-cycle Transformer

The surge generator installed at Witton consists of a number of electrostatic condensers arranged upon the Marx principle, *i.e.*, they are charged in parallel through vacuum rectifying valves, and discharged in series up to one million volts.

The wavefront of such a surge created by condensers discharging through a non-inductive resistance is somewhat indefinite but very short, not exceeding one micro-second, or that of a travelling wave due to lightning in a transmission line that has yet been measured.

The high-frequency generator (1,000 kV) consists of an air-core Tesla transformer; its primary coil, of V-shaped cross section, is fed at 50 cycles through a condenser and an arc, the latter being cooled by an air blast. Thus a series of h.f. damped trains is obtained, the successive trains following each other at the rate of 50 trains per second.

A large oil tank, which can be heated, has been provided for testing insulation; also water-spraying apparatus, and an Avery machine, probably the largest constructed, has been installed to enable post insulators of the type used to support isolating links, &c., in grid open-air sub-stations to be tested. They must withstand specified mechanical pulls longitudinally, at right angles, and torsionally as well as simultaneous vibration. The machine is of such dimensions as to permit of two complete posts being arranged to pull against one another whilst high voltage, up to the flash-over value, is applied to the centre.

Thus it will be appreciated that the new high-voltage factory and laboratory illustrated above constitute valuable additions to the already extensive manufacturing resources and research facilities of the G.E.C.

High-Voltage D.C. Plant

Each of the Regional Stations of the B.B.C. contains nearly 3,000 kW of running Plant

THE first regional station of the British Broadcasting Corporation at Brookmans' Park includes amongst its equipment three 160-kW, 12,000-volt d.c. generators; the recently completed north regional station at Slaithwaite is similarly equipped, but the generators in this case have an output of 220 kW each. The B.B.C. has just placed a contract with the English Electric Co., Ltd. (which carried out the two earlier contracts) for three 220-kW, 12,000-volt units of the same type for the Scottish regional station.

Machine Room at Slaithwaite

The special features of the 12,000-volt units for broadcasting service are to be found mainly in the construction of the armatures and the arrangements for maintaining a constant potential gradient between the various members of the machine structure. In the case of the North and Scottish stations each unit consists of a 350-h.p. direct-current motor driving a pair of 6,000-volt generators connected in series. These generators are four-pole machines in order to obtain the best mechanical construction of the end connections; the slot insulation is of pressed mica. The major insulation to earth is incorporated in the armature hub where it can be made of liberal thickness and be built-in solidly; this insulation is tested with alternating current at 20,000 volts, while the windings and commutator are tested at 11,000 volts a.c. to the core, making a total test pressure of 31,000 volts to earth.

A potential equaliser and trip gear is provided for each 12,000-volt unit to maintain the potential of each armature core at its correct value midway between the extreme potentials of the two commutators, thereby distributing the dielectric stress between the slot insulation and that in the armature hub. Special attention has been given to the elimination of ripples from the generated e.m.f., and any that persist are of extremely small amplitude.

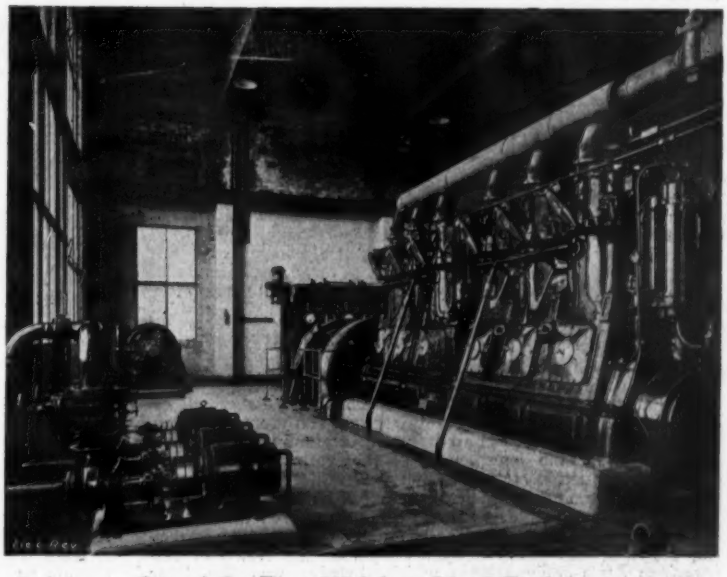
As in the case of the London regional station, the contract executed by the English Electric Co. for Slaithwaite included four oil-engine driven generators for the power house, each of 234 kW, three filament-current motor-generator sets, two battery charging sets, two boosters and a number of motors for driving the various auxiliaries in the power house. In addition the company constructed the 25-panel switchboard for the transmitter hall and two 11-panel and one panel switchboards for the power house and the auxiliary services.

As an indication of the demand for high-voltage direct-current machinery, over 11,000 kW of machines for operating on pressures from 1,650 to 20,000 volts have been supplied, or are under construction, by the company.

For further information regarding the B.B.C. plant at the Brookman's Park regional radio-telephone broadcasting station, the reader is referred to an article which appeared in the ELECTRICAL REVIEW of September 20th, 1929. In this article attention was drawn to the fact that the bed plates were not insulated as a protection against induced high voltage, because each armature is completely insulated from the earthed shaft by a micanite bush.

Special reference was also made to the 30-kW transmitters and their arrangement.

In conjunction with this article, the paper read by Capt. P. P. Eckersley and N. Ashbridge before the Wireless Section of the Institution of Electrical Engineers (ELECTRICAL REVIEW, May 16th, 1930), is also worth close study. The diagrams reproduced show clearly the interesting methods adopted for the insulation and the dielectric stress distribution of the motor-generators.



One of the Four 335-b.h.p. Diesel Engines

The E.H.P. Conference

THE sixth session of the International Conference on Large Electric High-tension Systems will be held in Paris from Thursday till Saturday, June 18th to 27th. Since the conference was created in 1921 sessions have been held every other year regularly. The next session will therefore give an opportunity for the celebration of the tenth anniversary of the creation of the Conference. Applications for registration have already been received from 525 engineers, representing 27 countries, and it is expected that the number of delegates will be greater than in 1929, when it was 703, which made the Conference by far the largest international electrotechnical association.

One hundred papers will be presented and debated; they will be grouped in three different two-day sections whose scope will cover the whole of electro-technics: steam and water power stations' lay-outs, overhead and underground transmission line design and insulation, network operation and interconnection. Some problems will be particularly closely investigated, namely: transformer oils, circuit breakers, "dancing" conductors, insulator research, and specifications. Moreover, a set of papers of an important bearing will allow an exhaustive study of the troubles due to lightning. It is claimed that the Conference has become the most active and comprehensive centre for information ever realised.

After the close of the session three tours will be undertaken, one to the Massif Central, the second to the Pyrenees, and the third to Alsace.

For registration please apply directly to Mr. Tribot Laspière, director and secretary, the International Conference on Large Electric High-tension Systems, Avenue Marceau, 54, Paris (formerly Boulevard Malesherbes, 25), who will furnish all information required by intending participants.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Conditions in Poland

The Department of Overseas Trade has published (through the Stationery Office, 1s. 6d. net) a report on economic conditions in Poland during 1930 by Mr. R. E. Kimens, C.M.G., Commercial Secretary at Warsaw. The report shows that although the economic situation was adversely affected by the world depression, factors of a local order contributed towards the aggravation of the situation. The volume of imports and exports was further reduced, the export trade from the United Kingdom being smaller in absolute figures, though as a percentage of the total imports it practically maintained its position. In addition to widespread trade depression which caused a general shrinkage in imports, it is thought that the smaller interest which United Kingdom exporters appear to have taken in 1930 in the Polish market may also have accounted for the reduction of British imports. An explanation may be that British firms have been discouraged by losses through bad debts, but it is considered that with the exercise of the necessary caution Poland will continue to be an advantageous market for the sale of British goods. Serious depression prevailed in all branches of electrical engineering, and no improvement is expected in the immediate future. Reference is made to the new British-made broadcasting station near Warsaw, which it is expected will stimulate the sale of cheap wireless sets. The financial position of municipalities and local governments has deteriorated, and consequently the prospects for British enterprise, in connection with public works, are not favourable for the near future. Particular attention, however, is directed to the efforts which are being made for the electrification of the country. With this end in view the Association of the Polish Electrical Industry is preparing, at the request of the Government, a scheme covering the whole of the country. An appendix to the report shows that Poland's imports of "electrical apparatus, conductors, and other electro-technical materials" during 1930 were valued at 71,104,000 zlote, while exports of this class had a value of 1,518,000 zl.

Electrical Manufacturing in Belgium

The Société des Ateliers de Constructions Electriques de Charleroi reports that the large machine department at Charleroi was well supplied with orders last year, and several contracts were received for large winding engine plants. Besides regular orders booked for tramways at home and abroad, the company was entrusted with the supply of equipment of four-motor coaches, for 1,500 V d.c., for the Brussels-Tervueren line, which will be the first application of electric traction on a large scale in Belgium. With regard to machines of average size normal activity was maintained, as was also the case with the small motor department.

Wages in the Engineering Industry

The proposals of the Engineering and Allied Employers' Federation for the modification of conditions of employment in the engineering industry and variations in the methods of payment were considered on May 7th by a conference of trade union representatives. The employers originally put forward suggestions for the lengthening of the working week to 48 hours, the reduction of the payment-by-results, night-shift and overtime rates, and the re-arrangement of shifts. These terms were somewhat modified at subsequent conferences. At a joint meeting of employers' and trade unions' representatives on May 8th the union delegates reported the result of the previous day's deliberations, which, briefly, was the total rejection of the employers' proposals on the ground that they "did not contain a reasonable basis for discussion." Sir Allan Smith, chairman of the Federation, expressed regret at this decision, and stated that the Federation would have to consider its next step at an early meeting.

Brighton Electrical Contractors' Dinner

Mr. A. C. Watts, of Tunbridge Wells, presided at the annual dinner of the Sussex branch of the Electrical Contractors' Association, which was held at the Old Ship Hotel, Brighton, on May 7th. The chairman, in proposing the toast of the Mayors, Corporations and Municipalities of Sussex, welcomed the proposals for the municipal showrooms at Brighton. Electrical contractors had, he said, been suffering from the effects of the trade depression, and prices had reached an almost uneconomic level and this, together with the large amount of cheap materials imported, made things very difficult. The Sussex branch was ready and willing to co-operate in any schemes to further the uses of electricity.

The Mayor of Brighton (Ald. S. C. Thompson) emphasised that under the Corporation's assisted wiring and hire-purchase scheme they desired the help and co-operation of the contractors, and he suggested that all contractors should join their Association. It had been decided to spend £40,000 on the showrooms, and the Corporation wanted these to be of assistance to contractors. The Mayor of Hove (Councillor E. E. J. Thompson) said that in his borough the electricity undertaking and the electrical contractors were working together on the best of terms. During the past ten years the distribution of electricity had increased by about 7,000,000 kWh. Ald. R. S. Chatfield, chairman of the Eastbourne Lighting Committee, submitted the toast of the Association and Allied Associations, and in reply Mr. Hazel (president) said the E.C.A. had never been in a stronger position.

Cricket and Electricity

We have received from Mr. W. H. Nichols, manager of the Engineering Department of Messrs. W. T. Henley's Telegraph Works Co., Ltd., a booklet published by the company containing the season's county cricket fixture list, and drawing attention to "Isco" service cut-outs. In his letter accompanying the booklet, Mr. Nichols says: "As I write the weather is good. May it so continue so that during the intervals of cricket the progress of electrical distribution may proceed unhindered."

Shift Workers' Wages

In the annual report of the West Midlands Area District Joint Industrial Council for the Electricity Supply Industry it is stated that during the year application was made by the trade union side for an all-round increase for shift workers (other than switchboard and sub-station attendants) employed in power stations, and the question was thoroughly investigated by the Standing Committee. The employers' side did not, however, consider that a case for such an increase could be justified, but they intimated that they recognised the coming of the super-station had increased the responsibilities of certain grades in these stations above what was contemplated when the original scheme was drawn up. They felt that this increased responsibility ought to be compensated by extra payment and they were, therefore, prepared to consider sympathetically the cases of turbine drivers and stokers. Agreement was reached with regard to these two classes, but the approval of the National Council to the settlement has not yet been received.

Lamp Manufacturers v. Contractors

Representatives of the Electric Lamp Manufacturers' Association and of the Electrical Contractors' Association of Scotland assembled to the number of 22 at Turnberry Hotel, Ayrshire, last week, to compete in the second annual match between the two bodies for the golf cup presented last year by Mr. S. H. Callow. The weather was good, and the result was a close one. E.L.M.A. won in the singles by five matches to three, and the Contractors in the foursomes by three matches to one. The result was therefore all square, six matches each, but on the byes being counted it was found that the Scottish side had won by a majority of seven byes. Last year E.L.M.A. secured the cup. Mr. J. Y. Fletcher presided at a dinner held in the evening.

Plastic Moulding Association

The first annual meeting of the British Plastic Moulding Trade Association (19, Ludgate Hill, E.C.4) was held recently. The chairman, Mr. Bernard Weaver, gave an account of the Association's activities since its inception in April last year, and said that the membership was now 30, embracing all the powder manufacturing firms, thirteen moulding firms, seven mould makers and plant manufacturers, and three raw material firms; each class had its separate section in the Association. To enable the members to meet three trade luncheons had been held, the average attendance being about a hundred. A model set of terms and conditions of sale for the Moulding Section had been drawn up and circulated to members, and at the British Industries Fair a plastics section was organised with satisfactory results. Among other matters, Mr. Weaver referred to the application made by B.E.A.M.A. for a Marking Order in respect of imported synthetic-resin insulating material. In this connection B.E.A.M.A. had sought the co-operation of the Association, and the question was now being dealt with jointly.

Capt. J. W. Barber (Brownie Wireless Co. (Great Britain), Ltd.) and Mr. C. Waghorne (Insulators, Ltd.) were appointed chairman and vice-chairman respectively for the ensuing year, and representatives of the following companies were elected to the Council:—Messrs. H. E. Ashdown (Birmingham), Ltd.; Streetly Manufacturing Co., Ltd.; St. Albans Manufacturing Co., Ltd.; Solidite and Synthetic Mouldings, Ltd.; Lorival Manufacturing Co., Ltd.; Callender's Cable and Construction Co., Ltd.; Birkbys, Ltd.; Ebonestos Insulators, Ltd.; Beetle Products Co., Ltd.; Kelacoma, Ltd.; Bakelite, Ltd.; F. C. Higgins & Son; Francis Shaw & Co., Ltd.; and Graesser-Monsanto Chemical Works, Ltd.

Proposed Showroom at Tonbridge

The Tonbridge Urban Council has asked the Electricity Committee to consider the question of the establishment of an electrical showroom. When the matter came before the Council on May 6th the chairman of the Electricity Committee said that the matter had been previously discussed, but the estimated cost was so high that the Committee had not seen its way to recommend the adoption of the scheme; the engineer had another scheme to place before the Committee.

New Showrooms at Londonderry

The new showrooms of the Londonderry Corporation Electricity Department, which were formally inaugurated on May 1st by Mrs. Welch, wife of the chairman of the Electricity Committee, have an imposing frontage with a large display window in which are shown electric cookers, fires, irons, &c. In the showrooms a well-arranged display of lighting fittings and other domestic appliances is on view, while special attention has been given to electric cookers by setting apart one room as a kitchen in which demonstrations of electric cooking are given. Simultaneously with the opening of the showrooms the Department has issued a booklet describing the many applications of electricity in the home, and containing suggestions to aid householders in selecting suitable appliances. A list showing the consumption of electricity by various appliances is included, together with the scale of charges for electricity. The output of electricity from the Corporation's power station in 1930 was 4,464,417 kWh, and it is anticipated that, with the aid of the new showrooms, the current year will show a considerable increase in the demand for electricity.

An Original Glass Display

At a recent exhibition of British glassware at Messrs. Selfridge's London stores, a glass display stand, manufactured at the Morley works of Messrs. Hailwood & Ackroyd, Ltd., attracted considerable attention. This consisted of a peacock, with outspread tail, moulded in glass of many colours, resting on glass blocks, with pillars on either side, surmounted by beacon lights. When illuminated the stand was strikingly attractive.

A Switchgear Display

The accompanying picture shows the main window of the E.G.S. Co., of Trafalgar Street, Newcastle-on-Tyne, displaying the switchgear products of Messrs. Wm. Sanders & Co., of Wednesbury. The display continues unchanged throughout the present month.

Sanders' Switchgear at Newcastle

Domestic Appliances for Malaya

A report has been issued by the Department of Overseas Trade, based on information furnished by H.M. Commissioner at Singapore, on the market for domestic electrical appliances in British Malaya. This states that there is good reason to anticipate that the increase in the demand for electric cookers and water heaters will continue. These appliances have proved satisfactory and economical in operation, and their use is encouraged by hiring schemes adopted by the Municipalities of Singapore and Penang, and the Electrical Department of the F.M.S. at Kuala Lumpur. It is pointed out, however, that the intense economic depression which now prevails must obstruct the development which might normally be expected.

Up to the present, sales have been effected principally among European residents. Recently the Straits-born Chinese have begun to take an interest in electric cookers. These two sections of the population do not provide a really wide market.

Business in the larger appliances, such as cookers, is almost entirely in the hands of British manufacturers. United States appliances are largely ruled out by price. As regards Continental appliances, it has been pointed out that European countries do not as a rule use a high supply voltage, although it is common in England, and that English practice in this respect is followed in Malaya. Moreover, while the English climate requires a higher standard of insulation than is either necessary or usual on the Continent, the hot, damp climate of Malaya is even more exacting. German makers find it difficult to compete with a product up to the standard required in this country, while the British product is well and attractively finished, and in this respect sets up a standard hard to equal.

The greater part of the trade in the smaller electrical domestic appliances is also in British hands, but the principal obstacle in the way of an expansion in sales is the conservatism of the Chinese. The most popular article is the electric iron. Firms desiring to open up trade relations for the first time are recommended to establish contact with some firm of importers in British Malaya on a sole agency basis. Preferably a firm with an engineering department should be chosen. Lists of importers likely to be interested are available from the Department of Overseas Trade.

A Novel Table Cooker Demonstration

An unusual demonstration was given last Monday by Messrs. LIGHTING TRADES, LTD., at their offices in Farringdon Street, London. To show the numerous applications and the facility of use of the "Stokes" electric table cooker, visitors were invited to cook their own meal, consisting of fish, steak, chop, bacon, sausages, tomatoes, &c. The cooker, which was described in the ELECTRICAL REVIEW of December 13th, 1929 (p. 1041), was eminently successful in cooking the articles mentioned in times ranging from three to ten minutes, and in addition showed itself fully capable of acting as a radiator, toaster, water heater, or plate warmer. In construction the cooker comprises an aluminium pan, about 10 in. in diameter and 2¼ in. deep, in the centre of which is fixed a 500-kW element and, when used as a cooker, is placed completely over the plate containing the food. There are consequently no pots or pans to wash up and none of the beneficial juices of the food are wasted.

Siamese Market for Radio Sets

According to the *Chamber of Commerce Journal* there is a fairly good market in Siam for radio sets of the not too expensive kind, although several sets are being marketed that are capable of receiving both long and short wave programmes. For the Siamese fiscal year 1929-30 radio sets and apparatus imported into the country approximated £64,200 in value, of which nearly one-half represented the value of supplies from Germany. The United States ranked second with a contribution valued at more than £2,000, while sets and apparatus imported from the United Kingdom exceeded £9,000 in value. It is reported from the office of the American Trade Commissioner at Bangkok that work will start shortly on the erection of another broadcasting station, the chief purpose of which will be to relay programmes from other countries, thus enabling local radio listeners to hear foreign programmes on small and inexpensive sets. During recent months a good deal of favourable publicity has been given to radio in the Siamese Press, and it is expected that imports for the year will exceed those of former years by a good margin. Manufacturers of all-mains sets should bear in mind that in Bangkok the electricity supply, rated at 110 V, a.c., is not constant, fluctuating at times between 80 and 130 V. At this high voltage the strain imposed on cheaper sets is sometimes more than they can stand, and the more sensitive parts are burned out. Sets originally designed for 110 V should be capable of withstanding a pressure of at least 140 V.

Bankruptcy Proceedings

F. V. HOWITT (trading as the Falksley Company), Riste's Place, Barker Gate, Nottingham, electrical and cinematograph engineer.—The public examination of this debtor was held on May 7th, at the County Court House, St. Peter's Gate, Nottingham. The statement of affairs showed a deficiency of £1,519, which was attributed to bad trade towards the end and heavy expenses. The debtor stated that in 1923 he became a partner in a company of electrical and cinematograph engineers, and introduced £420 as capital. For the year to March, 1923, a profit of £100 was earned. In 1925 the net profit was £283, and in 1926, £55. In March, 1927, the capital had been reduced to £32 and the partnership was dissolved, one partner being paid £13 as his share of the capital. In June, 1929, they took another into partnership, who brought in £420 as capital. It appeared that the salaries for the three partners had amounted to about £14 per week. In 1929 the other original partner retired, and the accounts prepared showed that he owed the firm £77, but it was agreed to pay him a sum of £100. The partnership was dissolved in June, 1930, since when the debtor in trading alone had made a loss of £84. He had been aware of his position since 1929, but thought he could pull the business round, as he had some good inquiries on hand. The examination was closed.

J. LAZARUS and M. LAZARUS, trading as "Langdon's Radio," wireless and electrical dealers, formerly of 13, Craven Park Road, Willesden, N.W.—The first meeting of creditors was held at the London Bankruptcy Buildings, a receiving order having been made on April 22nd at the instance of a creditor. The debtor M. Lazarus stated that in July last he began business as a wireless and electrical dealer with a capital of about £300. At first the business was very successful, but afterwards it suffered owing to competition. His brother, the other debtor, had taken no part in the business nor had he provided

any capital. The liabilities were £350 and there were no assets. The debtor attributed the failure to trade depression, severe competition, lack of capital and heavy overhead expenses. The case was left in the hands of the Official Receiver to be wound up in bankruptcy.

FREDERICK ASLETT COULSON, wireless factor and general agent, 273, Archway Road, Highgate, N.—The public examination of this debtor was held on May 6th before Mr. Registrar Warmington at the London Bankruptcy Court, the accounts showing liabilities £1,116 and assets £1,006. Questioned by the Official Receiver, the debtor said a previous bankruptcy was recorded against him in March, 1922, when the deficiency was about £13,500. No dividend was declared, but he obtained a discharge which became effective in October, 1924. In 1926, with a loan of £100, he commenced business as a wireless dealer at 302, Kentish Town Road, N.W. To develop it he raised moneys on his reversionary interest under his grandfather's will, which at the time of his first bankruptcy was contingent and subject to appointment by his mother. After his discharge from the proceedings his mother released her power by deed in order that he might borrow from a reversionary interest company; two or three years ago his reversion in part fell in and he became entitled to £2,000, out of which he repaid the charges he had created. In January, 1928, after an illness, he vacated the aforesaid premises and acquired a three years' tenancy agreement of a shop and basement at 273, Archway Road. He there conducted a retail wireless business from the shop, and used the basement for assembling inductance coils. In or about September, 1928, his shop was broken into and he sustained a loss of £85. Early in 1929 he sold the retail shop business for £600, with which he discharged his liabilities as a retailer. At some time in 1927 he gave accommodation to one Firth by accepting two accommodation bills for £600 and £300 respectively, in exchange for two post-dated cheques (which proved to be worthless); the said Firth discounted one of the bills for £300 with money-lenders, who sued witness thereon, and he had to pay £300 plus £100 costs. During the last twelve months of his trading he was unsuccessful, and he cut prices in order to obtain funds to meet pressing creditors, many of whom obtained judgments against him. In November last he closed his business and these proceedings immediately followed. He attributed his insolvency to liability under the accommodation bill, medical expenses, depreciation in value of car on hire purchase, law costs, a burglary, and trade depression. The examination was concluded. The following are among the creditors:—

	£		£
Barclay's Bank	69	London Electric Wire Co. & Smiths, Ltd. ...	182
Callender's Cable and Construction Co., Ltd.	97	Tunbrell & Deighton ...	26
A. H. Coulson	156	V. Zeitlin & Sons, Ltd. ...	80
Lalham, H. J.	33	Johnson & Phillips, Ltd.	51
R.L.M. Co., Ltd. ...	29	Boxfoldia, Ltd.	24

J. G. WADSWORTH (the Nene Road Electrical Co.), electrical engineer, &c., 10, Westfield Terrace, Higham Ferrers.—Trustee, Mr. T. Bengough, 6, The Parade, Northampton, Official Receiver, released April 15th.

W. H. QUINTRELL, electrical and mechanical engineer, Higher East Street, St. Columb Major.—Trustee, Mr. G. C. Hancock, 12, Princes Street, Truro, Official Receiver, released April 17th.

W. A. BEAUMONT, electrical engineer, 44, Warrengate, Wakefield.—Supplemental dividend of 4s. 4d. in the £, payable May 5th at the Official Receiver's office, 13, Burton Street, Wakefield.

A. S. DEACON (London Wireless Co.), wireless dealer, 32, London Road, Derby.—Receiving order made May 1st on debtor's own petition. First meeting, May 15th, at the Official Receiver's offices, 2, Regent Street, Park Row, Nottingham. Public examination, June 23rd, at the Court House, 20, St. Peter's Churchyard, Derby.

T. C. COTTRELL, electrician, 31, Autumn Street, Burley Lodge Road, Leeds.—Trustee, Mr. H. C. Bowling, 24, Lower Bond Street, Leeds, Official Receiver, released April 13th.

F. H. GRAHAM, electrician, 14, Hill Top Avenue, Harehills, Leeds.—Trustee, Mr. H. C. Bowling, 24, Lower Bond Street, Leeds, Official Receiver, released April 13th.

R. SMITH and D. A. SMITH (D. A. Smith & Co.), wholesale wireless dealers, 41, Skerton Road, Old Trafford, Manchester.—Last day for receiving proofs for dividend, May 23rd. Trustee, Mr. F. Murgatroyd, Byrom Street, Manchester, Official Receiver.

Company Liquidations

SELECTORS, LTD., wireless manufacturers, Dover Street, London, W.—The statutory meeting of creditors was held on May 8th at the Hotel Victoria, Northumberland Avenue, London, S.W. A statement of affairs was presented by Messrs. Greenhalgh, Sharp & Co., of 11, Waterloo Place, London, S.W., which showed liabilities of £26,569, of which £8,359 was due to unsecured creditors. The bank claimed £9,378, but it was stated that they were secured by the personal guarantee of the governing director of the company. In addition there were unsecured cash creditors for £6,777, and a contingent liability for the balance of rent due under leases of premises at Slough and London of £2,000. There was a partly-secured creditor for £99, who held securities valued at £43, leaving £56 to rank as unsecured. The total assets were £10,966, from which had to be deducted £527 for preferential claims, leaving net assets of £10,439, or a deficiency, subject to costs of liquidation, of £16,130. The issued capital of the company was £1,000, so that there was a total deficiency of £17,130. The company was incorporated in November, 1926, with a capital of £1,000, divided into 1,000 shares of £1 each. During the year to January, 1928, the turnover amounted to £30,920, with a gross profit of £6,920, and a net profit of £692. In the following year the sales increased to £32,964, with a gross profit of £10,557, and a net profit of £128. For the year to January, 1930, the turnover again rose to £63,950, and there was a gross profit of £21,064, with a net profit of £1,942. In the succeeding year the turnover fell to £44,444, with a gross profit of £12,953, but a net loss was sustained of £5,822. For the period from January 31st last to date, the sales had been £9,797, and there was a gross profit of £706, and a net loss of £3,564. It was reported that a meeting of the shareholders had been held that morning, when Mr. Sharp had been nominated as liquidator, and the creditors decided to confirm that appointment, together with a committee of three of the largest creditors. The following are the principal creditors:—

	£		£
Bryant, Robert	244	Premier Radio Co. ...	227
British Aluminium Co., Ltd.	129	Radio Instruments, Ltd.	121
Celestion, Ltd.	205	Rothermel Corporation, Ltd.	231
Cossor, Ltd., A. C. ...	116	Rabbitt, E. L.	207
Danipad Rubber Co., Ltd.	193	Telegraph Condenser Co.	165
Great Western Railway	129	Venesta, Ltd.	197
Halsey Bros. & Rist, Ltd.	206	Wingrove & Rogers ...	138
Lessel, Hutcheon, Ltd.	211	Mullard Wireless Co. ...	384
Lewis & Co., Ltd., B. ...	104	Marconi Wireless Telegraph Co., Ltd. ...	754
Morrell, W.	117	Osmond & Co., E. ...	220
Mallinson & Sons, Ltd.	434	Calders Piccadilly Property Co., Ltd. ...	136
Ormond Engineering Co.	205	Slough Estates, Ltd. ...	535

JONES BROTHERS (STREATHAM), LTD.—Winding up voluntarily. Liquidator, Mr. S. P. Child, 36 and 37, Queen Street, E.C.

D. O. WILLIAMS & Co., LTD.—Winding up voluntarily. Liquidator, Mr. J. Smith, Midland Bank Buildings, Castle Square, Swansea.

NEON LIGHTS (1928), LTD.—Meeting, June 15th, at the offices of Messrs. Ernest James & Co., St. Lawrence House, Trump Street, E.C., to receive an account of the winding up.

N.E.S. (BRADFORD), LTD. — Winding up voluntarily. Liquidator, Mr. W. Hustwick, 70, Kirkgate, Bradford.

Dissolutions of Partnership

BODDEY, PAGE & Co., wireless, electrical and experimental engineers, 16, St. Margaret's Green, Ipswich.—Mr. F. T. Boddey, Mr. F. A. Page and Mr. B. J. Suttle have dissolved partnership, so far as regards Mr. Suttle, who has retired from the firm.

J. & M. STONE, wireless and electrical factors, 303, Southampton Street, Camberwell, S.E.—Mr. J. Stone and Mr. M. Stone have dissolved partnership. Mr. J. Stone will attend to debts.

RADIO SERVICE Co., proprietors of a wireless relay service, 54, Hebrew Road, Burnley.—Mr. A. Wade and Mr. J. F. Lord have dissolved partnership. Mr. Lord will attend to debts and carry on the business at 3, Extwistle Street, Burnley.

Trade Announcements

MR. FREDK. MARPOLE has started business as an electrical engineer and contractor at Lower Halliford, Shepperton-on-Thames, and asks for catalogues dealing with domestic installations and appliances.

Messrs. E. K. COLE, LTD., have appointed Mr. L. G. Black, of 136, Holland Street, Glasgow, as their representative in the Glasgow area.

MR. E. E. FAIRLAMB, radio engineer, of 8, Stone Street, Gravesend, has opened additional premises at 37, Stone Street, as a new department for electric lamps, fittings, shades, and domestic appliances.

Telephone Manufacture in Australia

An inquiry is being held by the Commonwealth Postmaster-General's Department regarding the possibility of manufacturing within the Department telephone, telegraph, and other apparatus at present imported from abroad. The Defence Department factories at Lithgow and Maribyrnong are to be inspected to determine whether the machinery can be adapted for such a purpose.

Business Research and Management

The final meeting for the 1930-31 session of the Business Research and Management Association is to be held at Anderton's Hotel, Fleet Street, on May 19th. The speaker will be Mr. A. P. Young, M.I.E.E., manager of the Rugby works of the British Thomson-Houston Co., Ltd., and the subject will be "Budgetary Control as an Aid to Team Work." Mr. Young will discuss the psychological effect of a budgetary control system as a means of securing the co-operation of the entire organisation by providing an incentive for the personnel to take an active part and interest in the affairs of the company. The address will be illustrated by a number of lantern slides. The meeting will commence at 7 p.m., and is open to all who are interested in the subject.

Recent Contracts

The HART ACCUMULATOR CO., LTD., has received an order to supply seven batteries, each consisting of 55 Hart "STB" type 11-plate cells having a capacity of 250 Ah, required as part of the equipment of the South-East England Electricity Scheme. These batteries will be installed in transformer stations at Croydon, Colchester, Three Bridges, Ipswich, Woking, Reading, and Wimbledon.

STANDARD TELEPHONES & CABLES, LTD., has received an order from the General Post Office for a No. 1 C.B. manual exchange for Pinner (Middlesex) equipped with 3,340 lines and with an ultimate capacity of 9,500 lines.

The Newcastle-upon-Tyne Electric Supply Co., Ltd., has placed an order with Messrs. DAVIDSON & CO., LTD., Belfast, for the mechanical draught plant, &c., for the new Dunston station. The value of the contract is stated to be about £100,000.

Price Reductions

Messrs. A. REYROLLE & CO., LTD., announce reductions in prices of plugs and sockets and spare parts.

Catalogues Required

H.M. Trade Commissioner at Wellington, New Zealand, reports that a well-known firm wishes to obtain from British firms catalogues of electric vacuum cleaners and other domestic electrical appliances. British firms interested may obtain particulars on application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1 (reference C.X. 3557).

Book Notices

"High Frequency Alternating Currents," by Knox McIlwain and J. G. Brainerd. Pp. xiii+510; figs. 226. London: Chapman & Hall, Ltd. Price 30s. net.

"Electricity and Magnetism," by Vincent C. Poor. Pp. ix+183. London: Chapman & Hall, Ltd. Price 11s. net.

"An Outline of the Universe," by J. G. Crowther. Pp. xvii+376; figs. 150. London: Kegan Paul, Trench, Trubner and Co., Ltd. Price 12s. 6d. net.

"Grundsätzliches und Tatsächliches zu den Elektrizitätswirtschaften in Europa," by Dr. Joseph Legge. Pp. xi+206; figs. Dortmund: Verlag von Gebrüder Lensing. Price Rm.8.70.

"Die Elektrischen Maschinen, Vol. II," by Dr. Ing. M. Liwschitz and Dipl. Ing. Glöckner. Pp. viii+306; figs. 462. Leipzig: Verlag von B. G. Teubner. Price Rm.19.

"Materials Handbook," by George S. Brady. Second edition. Pp. xxiii+588. London: McGraw-Hill Publishing Co., Ltd. Price 25s. net.

New Catalogues and Lists

The EQUIPMENT AND ENGINEERING CO., LTD., 2 and 3, Norfolk Street, London, W.C.2.—A folder giving particulars of "Suchard" low-pressure air compressors.

The MIDLAND ELECTRIC MANUFACTURING CO., LTD., M.E.M. Works, Barford Street, Birmingham.—Two lists, giving details of small 5 to 15-amp. ironclad and teak-cased fuseboards.

The DRAYTON REGULATOR AND INSTRUMENT CO., LTD., West Drayton, Middlesex.—A leaflet illustrating the combined "J.C.E." volume meter and "Drayton M.S." regulator.

The BIRMINGHAM ELECTRIC FURNACES, LTD., Birlec Works, Tyburn Road, Erdington, Birmingham.—A leaflet describing a new range of "Birlec" furnaces designed for hardening high-speed tools, &c., at temperatures up to 1,350 deg. C.

E. K. COLE, LTD., Ekco Works, Southend-on-Sea.—A copy of the first number of the "Ekco Service Bulletin." The bulletin will be issued quarterly and will contain details of the company's latest circuits, together with hints and suggestions for the radio dealer.

The FEED WATER SPECIALISTS CO., St. Paul's Square, Liverpool.—A pocket diary for May and June, containing a number of engineering tables.

The STURTEVANT ENGINEERING CO., LTD., 147, Queen Victoria Street, London, E.C.4.—Publication No. 1,003, dealing with "Monogram" and other cast-iron fans.

HERBERT MORRIS, LTD., Loughborough.—An illustrated booklet (No. 289), entitled "Brain *versus* Brawn," giving details of "Morris" electric hoist blocks.

G.W.B. ELECTRIC FURNACES, LTD., Elecfurn Works, North Road, Holloway, London, N.7.—A leaflet referring to "Eternite" case-hardening compounds.

The SIEMENS & GENERAL ELECTRIC RAILWAY SIGNAL CO., LTD., Central House, Kingsway, London, W.C.2.—Pamphlet No. 2, entitled "Street Traffic Signals to Assist Police Control."

RHODES, BRYDON & YOUATT, LTD., Waterloo Engineering Works, Stockport.—Publications No. M.18, M.19, and 119, relating respectively to "Mopump" cellar drainers, belt-driven "Mopumps," and acceleration for central heating.

ROBERT HORNBY & CO., LTD., 7, Carlisle Street, Dean Street, London, W.1.—A 112-page illustrated catalogue of meters, motors, time switches, fuses, cables, wires, domestic appliances, and general accessories.

The MARTINDALE ELECTRIC CO., LTD., The Hyde, Hendon, London, N.W.9.—A leaflet describing the tool used in conjunction with "Martindale Commstones" for grinding the commutators of large machines on site.

FERRANTI, LTD., Hollinwood, Lancs.—List M.2, dealing with "Ferranti" moving-coil instruments.

G. & J. WEIR, LTD., Cathcart, Glasgow.—Publication No. 122, describing "Weir" electrically-driven two-throw reciprocating pumps.

DARWINS, LTD., Fitzwilliam Works, Sheffield.—A well-illustrated booklet relating to "Darwin" cobalt-steel magnets.

CROMPTON PARKINSON, LTD., Guiseley, Leeds.—A folder illustrating "Crompton Minor" fractional h.p. motors.

CARRON COMPANY, Carron, Falkirk.—A 68-page catalogue relating to cooking equipment for ships.

New Argentine Company

A new company has been formed in Buenos Aires with a capital of $200,000 paper with the object of manufacturing and dealing in electric accumulators.

Overseas Electrical Trade in April

There was a considerable shrinkage in both imports and exports of electrical goods, apparatus and machinery during last month as compared with April, 1930. The total value of electrical imports fell from £652,965 to £494,931, while that of exports declined from £1,410,763 to £1,049,163. Some details of the trade will appear in our next issue.

For Sale

Tenders are invited by the Cardiff Electricity Department for the purchase of a 500-V d.c. shunting locomotive.

(See our advertisement pages to-day.)

The Timber Market

Our Timber Trade Correspondent reports that the spot market for building and joinery woods lacks strength owing to the eagerness of weak holders to sell, and also to the decline in values for forward delivery. Imports, however, have been light this year compared with last, and stocks are moderate or light. Hardwoods are not brisk in demand. Mahogany and teak logs especially are arriving in smaller quantities this year. American wood shipments continue to be heavy compared with the consumption, and prices for large parcels are weak. Plywood is likely to firm up in value, for receipts from overseas are light compared with those that came forward in the early months of 1930.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price May 12th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5½d.	...
a	Ammoniac, Sal ... ... per ton.	£60	...
a	Ammonia, Muriate(large crystal) ,,	£52	...
a	Borax ... ... ,,	£17	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	5d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac T.N.... ... ... per cwt.	£4 5s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3½d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£85 to £90	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet and Foil ... ,,	1/1 to 2/9	...
b	Babbits Metal and Anti-friction Metals—		
	Grade I ... ... per ton net.	£106	£2 dec.
	Grade II ... ... ,,	£76	£2 dec.
	Grade III... ... ... ,,	£46	£2 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	7¾d.	...
c	,, Tubes (solid drawn) ... ,,	9¼d. to 9¾d.	...
c	,, Wire, basis ... ... ,,	8d.	½d. dec.
c	Copper Tubes (solid drawn) ... ,,	10½d.	...
g	,, Bars (best selected) ... per ton.	£75	...
g	,, Sheet ... ... ,,	£75	
g	,, Rod ... ... ,,	£75	
d	,, (Electrolytic) Bars ... ,,	£49 12s. 6d.	...
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£69 12s. 6d.	...
d	,, ,, H.C. Wire per lb.	7⅞d.	⅛d. dec.
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	...
h	Gutta-percha, fine ... ... ,,	nom	...
h	India-rubber, Para fine ... ... ,,	4½d.	½d dec.
i	Iron, Pig (Cleveland No. 3) ... per ton.	58/6	...
l	,, Wire, galve. No. 1, P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£18	10s. dec
g	Mercury ... ... per bot.	£22 7s. 6d. to £22 10s.	...
e	Mica (in original cases) small ... per lb.	6d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/1½d.	...
p	,, ,, drawn bars & rods ,,	11½d.	1d. dec.
p	,, ,, rolled strip & sheet ,,	1/0d.	1d. dec.
p	,, ,, wire ... ... ,,	1/0½d.	½d. dec.
o	Platinum ... ... per oz.	£4 15s.	5s. dec.
d	Silicium Bronze Wire ... ... per lb.	9½d.	...
r	Steel, magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£105 5s. to £106 5s.	£3 dec.
n	Wire, Nos. 1 to 16 ... ... per lb.	2/11d.	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Electricity Supply

Lighting, Domestic, Power

Barmouth.—ELECTRICITY SUPPLY THIS YEAR.—Arrangements have been made by the Urban District Council for a supply of electricity for the town to be available from Maentwrog by December. Extensions will be made later to Harlech and other neighbouring villages.

Barrow-in-Furness.—APPLICATIONS FOR SUPPLIES.—At a recent meeting of the Corporation Electricity Committee it was reported that a number of applications had been received for supplies in the villages of Beckside (Cartmel), Newby Bridge and Haverthwaite. The electrical engineer was asked to report further on the probable number of consumers and the estimated revenue. The cost of constructing an e.h.p. line from Cartmel to Haverthwaite, with a branch h.p. line to Newby Bridge and l.p. distributors in Haverthwaite and Newby Bridge, would be about £4,500.

LOAN.—The Town Council is to make application for sanction to the borrowing of £1,000 for the purchase of meters.

Bath.—NEW OFFICES AND SHOWROOMS.—The Corporation is to spend £24,000 on new offices and showrooms in order to meet the demands of rapidly increasing business. The extensions will adjoin the existing building.

Birkenhead.—NEW SUB-STATIONS.—The Corporation Electricity Committee is to proceed with a scheme for the erection and equipment of sub-stations in Patten Street and Bidston Road, and kiosks at Upton and Heswall. The total cost of the scheme will be £19,480.

Blackburn.—ASSISTED WIRING.—The Corporation Electricity Committee is considering an assisted-wiring scheme for the town.

Bolton.—HEATING OF CIVIC BUILDINGS.—The new civic buildings will probably be heated by electricity. The Town Hall Committee favours the system of a central electrode water heater and thermal storage system of heat accumulation.

Bradford.—EXTENSIONS.—The Corporation Electricity Committee has decided to extend mains at an estimated cost of £7,857.

STREET LIGHTING.—Despite a recent decision of a special committee to recommend the continuance of gas lighting in all streets of the city except tramway and railless-car routes (which for some time past have been electrically lighted), the Corporation Electricity Committee has authorised its chairman, deputy chairman, and city electrical engineer to investigate whether the lighting of the whole city by electricity would not effect a financial saving for the Corporation and, if so, to make a report to that effect to the special committee on street lighting.

Bromley.—WIRING SCHEME.—The Town Council has adopted a scheme for the wiring of houses with from four to twelve lighting points, and from one to five heating points. The borough electrical engineer is to circularise recognised contractors within the borough with a view to entering into an agreement. Only the best British material is to be used.

STREET LIGHTING.—The Town Council has instructed the borough engineer to submit a comprehensive scheme for lighting certain thoroughfares by centre suspension electric lamps.

Burnley.—PROPOSED BULK SUPPLY.—The question of the advisability of negotiating with the Central Electricity Board for a bulk supply of electricity during next winter is to be further considered at the next meeting of the Corporation Electricity Committee.

Carlisle.—EXTENSIONS.—The Town Council has received sanction to the borrowing of £4,850 for mains extensions to Denton Pit and Kirkhouse.

Cirencester. — ELECTRICAL DEVELOPMENT PROPOSALS. — The Rural District Council has received proposals from the Wessex Electricity Supply Co. for the development of the supply of electricity in a portion of the Council's area. Other parishes in the rural area are scheduled in the West Gloucestershire Power Company's area of supply.

Clacton-on-Sea.—LOANS.—The Urban District Council has applied for sanction to loans of £570 for the conversion of the existing cooler into an open type cooler, and £375 for an additional 500-kVA transformer.

Colchester.—PURCHASE OF WALTON UNDERTAKING.—The Corporation Electricity Committee, having regard to the terms of the agreement for the purchase of the Walton undertaking, is to apply for sanction to loans of £10,250, the cost of acquiring the undertaking, and £11,300, the estimated cost of developing it.

BULK SUPPLY TO BRIGHTLINGSEA.—Sanction has been received to the proposed arrangement between the Corporation and the Frinton-on-Sea and District Electric Light & Power Co., Ltd., for a bulk supply of electricity by the Corporation to the company's undertaking at Brightlingsea.

HOSPITAL SUPPLY.—The Electricity Committee is to provide a new cable and transformer at the Infectious Diseases Hospital, Mile End, at a cost of £430.

Continental.—SWEDEN.—The Swedish Water Power Union, in a report for 1930, shows that the total water power resources of the country exploited with modern plants at the end of 1930 amounted to 1,277,000 kW. The electric power produced by steam engines was only 340,000 kW. The total production of electric power amounted to 5,250,000,000 kWh (of which 4,800,000,000 kWh was produced by water power), as compared with 4,982,000,000 kWh in 1929. During 1930 the construction of private power plants, totalling 32,000 kW, was started, and plants totalling 70,000 kW were completed. At the end of the year private plants totalling 67,000 kW were under construction, including the Hoeljebro plant on the Ljusnan river belonging to Bergvik och Ala Nya Aktiebolag (10,000 h.p.), the Maansbo plant on the Dalaelven, belonging to Alby Nya Kloratfabriks Aktiebolag (7,900 h.p. for the first stage of construction), the plant of Avesta Jernverks Aktiebolag, opposite the Maansbo plant (7,500 h.p.), and the third unit of the privately-owned Lanforsen station (13,000 h.p.). Preparatory work has also begun for the installation of a third unit at the Government-owned Motala station, and new Government-owned plants are under construction at Vargoen, not far from Trollhaettan on the Goeta, at Sillre, on a tributary of the Indals, and at Malfors on the Motala river. The report says that Sweden will soon reach the point when the large and medium-sized water power resources in the south and central parts of the country will be fully exploited. Power plant constructors will then turn more and more to the southern parts of North Sweden (Norrland). The capital invested in the water-power production of electricity in Sweden is estimated at between kr. 900,000,000 and kr. 1,100,000,000. Sweden takes the eleventh place among nations of the world in the annual production of electricity, but on a *per capita* basis of the population comes next after Norway and Canada.—*Reuter's Trade Service* (Stockholm).

GERMANY.—The *Financial Times* states that the proposal to sell the existing Berlin municipal electricity works, known as "Bewag," in order to enable a consortium of leading German and foreign banks to reconstruct the company under the new name of Berlin Light and Power Company, was recently passed by the Berlin City Council by 104 against 100 votes. By a slight alteration in the original scheme the City Council will have 25 per cent. of the voting power. The new company will have a share capital of Rm.240,000,000 (£12,000,000).

ITALY.—La Società Forze Idrauliche del Ceno, of Parma, has recently secured a concession to establish a plant to utilise the water power of the River Ceno near Varzi, where it is estimated about 9,480 h.p. is available.

TURKEY.—The report of the Société Turque d'Electricité for the last financial year shows that at the end of December last the company was supplying electricity to 61,688 consumers, as against 55,371 at the end of 1929. The load on the station increased from 54,747 kW to 60,956 kW and the sales of power amounted to 61,954,794 kWh, as against 55,239,325 kWh in the preceding twelve months, an advance of over 12 per cent. In order to meet the increasing demand a new 22,500-kW turbo-generator is to be added to the power station at Silighdar. During the year a new 35,000-V feeder was laid between the power station and the centre of Pera, while this year the 10,000-V lines which supply power from the station to the Bosphorus and Yedi-Coule are to be converted to 35,000 V.

SWITZERLAND.—According to the *Schweizer Industrie Zeitung*, the maximum capacity of the electric power stations in Switzerland advanced during the twelve months ended with October last from 885,000 to 935,000 kW. Owing to the industrial depression, however, the total output of electricity fell from 3,770,000,000 kWh to 3,680,000,000 kWh.

Dover.—BULK SUPPLY.—At a special meeting of the Town Council held last week it was decided to negotiate with the Central Electricity Board with a view to taking a bulk supply.

Dumfries.—ASSISTED-WIRING AND HIRE-PURCHASE SCHEMES.—The Corporation has approved a report by the manager with regard to the carrying out of schemes of assisted wiring, and hire and hire-purchase of electrical apparatus. The scheme includes the provision of show and demonstration rooms.

Eastbourne.—SUPPLY FOR HAILSHAM.—The Town Council is to apply for sanction to a loan of £14,076 to cover the cost of providing a supply of electricity for Hailsham.

Hastings.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains from Ore sub-station to Fairlight Road at an estimated cost of £325.

Hull.—SUPPLY AGREEMENT WITH L.N.E.R.—After prolonged negotiations the Corporation Electricity Committee has succeeded in arriving at an agreement with the London and North Eastern Railway which covers the whole of its supplies within the area with a comprehensive wayleave. Under the agreement the Electricity Department will acquire the necessary powers to supply all tenants on the Docks and Railway Company's property, and, in addition, the right to lay cables and put down sub-stations will be obtained. The agreement also includes the taking over by the Electricity Department of various cables and overhead lines which are at present the property of the Railway Company. These will be taken into the Department's general supply system. The financial terms were approved by the Electricity Committee in June, 1930.

PROGRESS STATISTICS.—During the year ended March 31st last the Corporation electricity undertaking generated 122,762,770 kWh of electricity and made 8,208 new connections, of which 4,218 were under its assisted wiring scheme. Electric cookers installed numbered 1,935 as compared with 239 in the preceding year, whilst the number of electric kettles installed increased from 156 to 1,775. The value of apparatus on hire amounted to £4,390.

Inverness.—THE EXTENSION ORDER.—At a recent meeting of the Town Council the following communication from the Electricity Commissioners was read with regard to the Inverness Electricity (Extension) Order: "Failing agreement as to the purchase of the undertaking at Inshes, the Commissioners are of the opinion that the Corporation should endeavour to agree to terms for a lease of the undertaking and water rights so that it could be run in conjunction with the Corporation's undertaking; or, failing agreement on this point, the Corporation should endeavour to obtain more favourable terms for renewing the agreement for reciprocal supplies, which was until recently in force." The letter added that the Commissioners were of the opinion that the matter was capable of adjustment on the lines of one of the alternatives. The convener of the Electricity Committee reminded the Council that it was the late manager's contention that the Council should have nothing to do with the Inshes scheme. Electricity was not required by the Council as the Bught scheme now ensured sufficient supplies. It was decided to reply to the Commissioners' letter on these lines.

Kirkcudbright.—SPECIAL ORDER.—The Dalbeattie Electric Light and Power Co., Ltd., in conjunction with certain important London interests, has communicated with the Kirkcudbright County Council intimating its intention to make application to the Electricity Commissioners for a Special Order authorising it to distribute electricity in the county.

Leeds.—NEW SUB-STATIONS.—The Corporation Electricity Committee has voted £35,400 for new sub-stations with manually-operated equipment.

LOAN SANCTIONED.—Sanction has been obtained to the borrowing of £33,000 in connection with the Kirkstall generating station. Lord Harewood has accepted an invitation to perform the official opening ceremony of this station on July 6th next.

CO-ORDINATION OF GAS AND ELECTRICITY DEPARTMENTS.—As an experiment arrangements are to be made for the inauguration of a system of joint meter reading and cash collection from prepayment meters in a district to be selected by the managers of the Corporation electricity and gas undertakings.

Liverpool.—EXTENSIONS.—In connection with a supply of electricity to Longmoor Lane, Fazakerley, permission has been obtained to the erection and equipment of a sub-station, at an estimated cost of £1,700, and to the extension of h.p. and l.p. mains, at an estimated cost of £1,663. The city electrical engineer has been authorised to supply electricity in various portions of the Speke estate, at a total estimated cost of £1,473, and extensions of mains are to be carried out in the Little Crosby and Water Street areas, at an estimated cost of £2,873. The town clerk is to apply to the Minister of Transport for permission to erect overhead lines in Little Crosby and Huyton.

PRICE REDUCTION.—It has been decided that the scale of charges for electrical energy for heating by tubular heaters shall be reduced to 0.6d. per kWh in approved cases.

London.—CLERKENWELL.—The London County Council is to ask selected firms to quote for the provision of two electric lifts at the Clerkenwell stores depôt.

Lowdham (Notts.).—STREET LIGHTING.—The Parish Council is to light the streets of the village by electricity.

Manchester.—PROGRESS DURING MARCH.—During the month of March the Corporation electricity undertaking showed an increase of 9,777 kW in connections, bringing the total up to 443,272 kW. Applications received for supplies, including additional supplies, amounted to 1,536, representing a total of 3,472 kW. The number of hired cookers increased by 130, making a total of 7,486 now on circuit. Applications for the hire of cookers numbered 170. Three new sub-stations were put into commission and new plant was installed at the Cheetham Hill sub-station. The change-over from d.c. to a.c. had been completed in the cases of 14,310 consumers up to March 31st, while work was in progress involving 2,180 consumers.

North Bedburn (Co. Durham).—ELECTRICITY SUPPLY SCHEME.—The Parish Council is to make application to the Unemployment Grants Committee for financial assistance in regard to a proposed electricity scheme for the village.

Pattingham (Wolverhampton).—INAUGURATION OF SUPPLY.—A supply of electricity to the village, provided by the Wolverhampton Corporation, was inaugurated on May 7th. The energy is conveyed by a h.p. main which will later be extended to Patshull, Weston, and Brewood, thus linking up a chain of villages on the western side of Wolverhampton.

Plymouth.—HEATING OF HOSPITAL.—The Corporation Health Committee has approved a scheme for the heating of the Hospital by electricity and is to make application for sanction to the borrowing of £9,354, the estimated cost of providing the equipment. The borough electrical engineer is to prepare plans and specifications and invite tenders for the work.

Portsmouth.—NEW SUB-STATION.—The Corporation Electricity Committee is to erect a sub-station in Francis Avenue.

Retford.—ELECTRIFICATION OF PUMPING PLANT.—The Corporation has adopted the suggestion of the Ministry of Health for the complete electrification of its sewage pumping plant. The plans have received the approval of the Ministry, and particulars are being prepared for tenders.

Rotherham.—EXTENSIONS.—The Corporation Electricity Committee is applying for sanction to the borrowing of £4,750 for the extension of cables and the erection and equipment of sub-stations in connection with the supply of electricity in the Brinsworth area.

REDUCTION OF POWER CHARGES.—The Corporation Electricity Committee recommends that the charge to power users at present entitled to a basic rate of 1.25d. per kWh with sliding scale shall be reduced to 1.20d. per kWh with sliding scale.

Salford.—TARIFF ALTERATIONS.—The Corporation Electricity Committee has decided to substitute "all-in" tariffs for the alternative lighting annual charge for business premises, as from July 1st next. The scale of discounts and advances according to power factor for power consumers is also to be applied to a.c. consumers with a maximum demand of 50 kW or over who are charged on the ordinary or sliding scale power rate.

Seaham.—NEW TRANSFORMER FOR SANATORIUM.—In order to deal with the additional supply of electricity required for the new buildings at the County Sanatorium, the Durham County Council proposes to substitute a new transformer of double the capacity of the existing one, at an estimated cost of £625.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electricity Supply Committee is to extend mains at a total cost of £5,857.

Stanhope.—STREET LIGHTING IMPROVEMENTS.—The Urban District Council Ways and Works Committee is to take up with the Cleveland and Durham County Electric Power Co. the question of improving the street lighting of the town.

Sunderland.—PROGRESS OF THE GRID.—A commencement has been made in the Sunderland area with the first stages of the North-East Area grid scheme. It is hoped to have the whole of the north-eastern section linked up with the national grid before the end of the current year. The first line to be dealt with is that between Sunderland and South Shields, and most of the lines in Sunderland itself will be underground.

Walsall.—MAINS EXTENSIONS.—The Corporation Electricity Supply Committee is to extend mains along Three Crowns Hill, Sutton Road, at an estimated cost of £430.

Warrington.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £20,000 for mains and services.

Worcester.—LOANS.—Sanction has been received to a loan of £15,985 for the extension of the Corporation electricity undertaking. In addition application for sanction to a loan of £2,000 for switchgear is recommended by the Electricity Committee.

Traction

Australia.—BRISBANE.—A profit of £8,756 was made last year on the city tramways. This is the fourth year in succession that a profit has been made, and the losses incurred on the omnibuses which were operated some years ago have been wiped out.

Barrow.—PROPOSED TRAMWAY ABANDONMENT.—The Town Council is contemplating abandoning its tramway system and substituting 'buses.

Bournemouth.—YEAR'S WORKING.—A profit of £8,184 was made last year from the Corporation transport services. Of this sum £1,282 has been allocated to the relief of rates. There was an increase of over 2,000,000 in the number of passengers carried on the trams and 'buses, the total being over 38,000,000.

Bradford.—ALTERATION OF TRAMWAY DEPÔT.—The Corporation is to adapt the tramway depôt for the accommodation of railless-cars at a cost of £1,200.

Burnley.—TRAMWAY ABANDONMENT.—The substitution of 'buses for tramcars on the Harle Syke-Rosegrove route was approved by 29 votes to 13 at a recent meeting of the Town Council.

Continental.—FRANCE.—The Orleans Railway Co. is about to place contracts for the electrification of its line between Tours and Les Aubrais. The work, which is expected to occupy from three to four years, will complete the electrification of the whole line between Paris and Tours (about 149 miles), and will involve the establishment of a 90,000-V transmission line between Chaingy (Loiret) and St. Pierre-des-Corps, near Tours, and five 90,000/1,500-V sub-stations.

Gateshead.—FRONT EXIT FROM TRAMS.—The Corporation Watch Committee is to recommend the Council to ask the tramway company to abolish front exit from trams owing to the number of accidents which have been attributed to the system.

Liverpool.—EXTENSION OF TIME.—The Minister of Transport has further extended, until May 26th, 1932, the period limited for the completion of the light railway authorised by the Liverpool Corporation Light Railway Order, 1925.

London.—TUBE EXTENSIONS.—Special general meetings of the Metropolitan District Railway, the London Electric Railway, the City and South London Railway, and the Central London Railway Companies were held at the Central Hall, Westminster, on May 5th for the purpose of approving a Bill empowering them to extend the Bakerloo section from the Elephant and Castle to Camberwell Green, at a total estimated cost of £1,875,000, to reconstruct the Central London stations at Chancery Lane and the Post Office, and to make other extensions and improvements. The resolution was carried unanimously at each meeting.

TRAMWAY ESTIMATES.—At a recent meeting of the London County Council the Highways Committee submitted a report and the annual estimates in respect of the tramway undertaking for the year 1931-32. It was estimated that the total receipts would amount to £4,477,110, and that the working expenditure, including renewals and special charges, would be £3,651,590, which would leave a gross profit of £825,520. After deducting the net loan charges it was anticipated that there would be a net surplus of £63,804. The approximate results for the year 1930-31 were: Total receipts, £4,366,500; working expenses, £3,611,242; gross profit, £755,258; and net profit, £32,979.

OXFORD STREET TRAFFIC SIGNALS.—The automatic traffic control system from Marble Arch along Oxford Street to Tottenham Court Road will be put into operation at the beginning of next month.

New Trolley 'Bus.—SUNBEAM CAR.—A recent addition to the list of motor-'bus manufacturers who have turned their attention to this class of passenger carrier is the Sunbeam Motor Car Co., Ltd., which has lately completed its first double-deck trolley 'bus. The design of the chassis, which has a 17-ft. wheelbase, is based upon that of the S.M.C. six-cylinder petrol six-wheel 'bus, the main difference being the substitution of a Metropolitan-Vickers electric motor and B.T.-H. control gear for the petrol engine, clutch, and gear box. The resistances of the electric transmission equipment are accommodated in a steel and asbestos-lined box, with open ends for cooling, carried behind the panelling on the off side.

Sunderland.—RELAYING OF TRACK.—The relaying of the tramway track at Monkwearmouth is to be undertaken by the Corporation within the next few weeks.

AUTOMATIC TRAFFIC CONTROL.—The Ministry of Transport has notified the Corporation that it is prepared to give a 60 per cent. grant towards the cost of changing the automatic traffic-control system in the town from a one-way to a two-way system. The cost is £1,437.

Telegraph and Telephone

Australia.—CABLE TELEGRAPHY.—The Cabinet Sub-Committee consisting of the Prime Minister, the Postmaster-General, and the Attorney-General, which has been putting the finishing touches to the agreement between Imperial and International Communications, Ltd., and Amalgamated Wireless (Australasia), Ltd., has decided that the Amalgamated Co. shall have control of the cable terminals in Australia.—*Reuter* (Canberra).

Austria.—RADIO COMMUNICATION WITH AMERICA.—As a result of recent arrangements between the Austrian Radio Communication Co. and the Mackay Radio and Telegraph Co., a wireless telegraph service has lately been inaugurated between Vienna and New York.

India.—TELEGRAPHY AND TELEPHONY.—Our correspondent in India states that during the past year the line mileage increased by about 1,200 miles, 10,500 miles of wire, 59 miles of cable, and 3,670 miles of cable conductors. New construction included about 6,000 miles of wire erected for the various railways and 1,840 miles of wire for the irrigation department. At the end of the year there were altogether 103,180 miles of line carrying 477,000 miles of wire and 1,132 miles of cable containing 86,000 miles of conductors. During the year 24 miles of underground telephone cables were laid in connection with the opening of new telephone exchanges and also to replace aerial lines. Baudot continues to be the principal multiplex telegraph system in use. "Teletype" working was introduced at Calcutta and duplex working was also tried experimentally at Delhi.

FOREIGN COMMUNICATIONS.—Satisfactory communication was maintained with countries in the west by the three routes: the Indo-European route connecting Karachi through Persia and the continent with London, the Eastern Telegraph Cable Company's route *via* Suez, and the Indian Radio Telegraph Company's beam wireless route. No serious interruptions occurred on any of these routes and cable communication with Australia was satisfactorily maintained throughout the year. Communication with China, *via* Bhamo, and with Siam, *via* Moulmein, was interrupted on several occasions owing to breaks on the land lines within and beyond the Indian limits.

TRUNK TELEPHONES.—Nine additional trunk circuits were provided during the year. A single-channel carrier-current set was installed experimentally on an existing telephone circuit between Delhi and Agra to obtain an additional channel without the erection of new wires. Speech on the new circuit is fully commercial and up to the standard obtainable on a physical circuit. The system has the advantage of working satisfactorily through line defects which interrupt the ordinary channel. The number of exchanges owned and maintained by the Government was 291 with 18,786 straight-line connections and 3,024 extension telephones.

WIRELESS PROGRESS.—There was considerable progress in wireless equipment and new construction and reconstruction was completed in several places. The short-wave sets at Calcutta, Rangoon, and Madras constructed as an experimental measure during the previous year were brought into regular use.

INCREASE IN TRAFFIC.—Satisfactory communication was maintained between coast stations and ships at sea. Wireless communication was maintained satisfactorily through Peshawar with Kashgar and through Rangoon with Penang and Sabang. The wireless service between Burma and the Straits Settlements was discontinued as it was little used. The wireless route between Peshawar and Kabul carried heavy traffic. The Wheatstone method of operating the Madras-Rangoon high-speed duplex wireless circuit has been made a regular arrangement throughout the year with satisfactory results. In addition to long-wave communication the short-wave sets at Madras and Rangoon proved particularly useful during troublesome periods of atmospheric interference. The experimental short-wave installations at Calcutta and Rangoon were brought into regular use and were of great value during breakdown of the Indo-Burma lines.

International Telephony.—DENMARK-SWEDEN CABLE.—The Swedish and Danish telegraph departments have recently placed a joint contract with the Siemens and Halske Co. of Berlin for a new 35½-mile telephone cable between the two countries, the submarine Pupinised length of the cable between Barback and Charlottenlund to be about 14¼ miles. The cable, which is intended partly for two-wire and partially for four-wire operation, will also include a core intended for radio broadcast transmission.

SWEDEN-RUSSIA.—Telephone communication between all Swedish exchanges and Moscow and Leningrad, *via* Helsingfors, was established recently.

Siam.—RADIO-TELEPHONY.—Since April 15th last a radio-telephone service has been in operation between Siam and Germany (Bangkok-Berlin).

Switzerland.—TELEPHONE FINANCE.—The 1931 budget of the Swiss Posts and Telegraphs Department includes a sum of £333,856 for new telegraph and telephone lines and cables and £389,360 for new instruments and internal equipment.

The Telephone Service.—TRUNK CALLS.—Official statistics show that, if the present rate of increase of the number of telephones is maintained, there will be two million telephones in the country by the end of May. The total number in use at the end of February was 1,971,098, which represents an increase of 9,157 over the previous month's total and 100,398 over the total for the corresponding month last year; 708,533 of those telephone stations were in London. Inland trunk calls in 1930 numbered 120,310,016, representing an increase of almost 4,000,000 over the 1929 figure. Outgoing international calls in 1930 totalled 542,568 (an increase during the year of 14,672, or 2.8 per cent.) and incoming international calls 583,651 (an increase of 13,566, of 2.4 per cent.).

Radio

Australia.—Almost £5,000,000 is invested by over 320,000 licensed listeners in receiving apparatus, according to an article by the Director-General of Posts and Telegraphs in the year book published by the Australian Broadcasting Company, Ltd., apart from the money invested in transmitting stations and in the equipment of factories for the supply of radio apparatus. Plans have been prepared for a satisfactory service to 95 per cent. of the population and a less efficient service to the remaining five per cent., principally located in the far distant parts. It is explained that the best means of securing variety and effectiveness is by linking the principal "A" stations, but that Australia is at a disadvantage inasmuch as its degree of settlement does not justify a big extension of long-distance telephone cables capable of providing the satisfactory transmission of the varied frequencies required in the successful relay of musical programmes.

The chairman of the company states that its first year was one of extreme difficulty. The company had to face definite hostility to centralised control. It would have been possible to have created a surplus on the year's working, but they decided to expend additional money on improved programmes instead. The superintendent manager points out that during the first year of the company's control the number of licensed listeners in the Commonwealth increased from 302,539 to 322,403, which he considers satisfactory in view of the financial depression. He believes that with the establishment of relay stations and improvement in relay connections between the different States the influence of broadcasting will be extended.

Canada.—LICENCES.—Of the total 514,701 receiving licences in use in 1930, Ontario had 257,275, which is almost exactly one half. Toronto residents took out 80,342, being the largest number of any Canadian city. In Montreal there were 44,059. The increase for the year was 90,550 for the Dominion, says *World-Radio*, of which 18,480 were for Toronto, but only 1,064 for Montreal. A few smaller places recorded decreases.

Europe.—LICENCES.—The number of licensed receiving sets in Europe increased during 1930 from 8,346,066 to 9,853,465, figures which are made known for the first time by the Geneva office of the International Broadcasting Union in its annual chart showing the comparative growth of broadcasting in the

various European countries where the licensing system prevails. According to *World-Radio* it includes a greater number of countries than hitherto (23 against 18 last year), and on December last the Danish figure had risen to 119.5 sets per thousand inhabitants, which gives Denmark an unchallenged position. Sweden's figure is second this year, 78.99 per thousand, which is due to the issue of 482,300 licences amongst a population of just over 6,000,000. Great Britain again takes third place, but has gained slightly upon Sweden. Austria has fourth place, and Germany retains fifth place, but with an important increase from 49.1 at the end of 1929 to 56.23 per thousand in 1930. The latter figure represents an increase of over 440,000 listeners (at least 10,000 more than in the previous year). Sixth amongst the European countries comes Hungary once again, with an increase from 30.77 to 35.79.

India.—LICENCES.—Our correspondent in India reports that the number of licences of all kinds increased all round; broadcast receiving licences rose from 6,400 to 7,700. The numbers of fixed stations and mobile stations licensed were 171 and 31, respectively. Permission to broadcast was given to the Corporation of Madras.

Irish Free State.—WIRELESS TAXES.—In his budget statement in Dail Eireann, Mr. Ernest Blythe, Minister for Finance, said that they had taxes of two kinds on wireless reception. The duty on apparatus was estimated to bring in £35,000 this year. It was calculated that the establishment of the high-power station at Athlone would so increase receipts that all the expenses of broadcasting could be met out of income. Accordingly it did not appear to be inappropriate to regard the cost of erecting and equipping the new station as a capital item which might be defrayed out of borrowed money. The tax for the past financial year had produced £4,500 more than in the previous year.

North Regional Service.—NEW STATION.—The British Broadcasting Corporation announces that as from Sunday next, May 17th, the new north regional transmitter at Moorside Edge will radiate the full daily service on a wavelength of 479.2 metres. The only other station in that area which will continue to function will be that at Newcastle-on-Tyne.

Radio Exchange.—OTLEY.—The U.D.C. Highways Committee has refused an application of the Radio Relay Co., of Bradford, for permission to erect overhead wires in the district.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

AUSTRALIA.—Melbourne.—May 26th. Posts and Telegraphs Department. Lead covered multiple twin telephone cable. (A.X. 10892.)*

July 7th. Accumulator batteries. (A.X. 10893.)*

Sydney (N.S.W.).—Government Railways. One 2,500-kW alternator for Lithgow power station. The date for reception of tenders has been extended from April 8th to July 8th. (A.10904.)*

BELGIUM.—Antwerp.—May 28th. Municipal Council. Two electrically-operated haulage winches. Copy of the *cahier des charges* (No. 904) from the Hôtel de Ville, Antwerp (5 fr.). (A. 10905.)*

BULGARIA.—Sofia.—May 18th. Ministry of Railways. Copper sheet, wrought, wire and tubes. (A. 10902.)*

BRADFORD.—May 23rd. Corporation. Electric lighting installation in 770 houses on the Chellow Grange estate. Specification and form of tender from the city architect, Town Hall.

CHILE.—Santiago.—June 30th. State Supplies Department. Electric wire. (C.X. 3550.)*

DUNFERMLINE.—May 30th. Fife County Council. Electrical work at new High School, Dunfermline. Schedules (deposit £2 2s.) from Messrs. C. R. Douglas & Son, Prudential Buildings, East Port, Dunfermline.

ECCLES.—May 20th. Electricity Committee. Twelve months' supply of single-phase a.c. house service integrating watt-hour meters. Specifications (deposit £1 1s.) and form of tender from the borough electrical engineer, Electricity Works, Cawdor Street, Patricroft.

EDINBURGH.—May 19th. Office of Works. Three boilers (2½ million B.T.U.). Forms of tender from the engineer, H.M. Office of Works, 122, George Street, Edinburgh (deposit £1 1s.).

May 20th. Corporation. Installation of electric lighting at nine schools. Particulars from the city architect, City Chambers.

EGYPT.—Cairo.—June 24th. Ministry of the Interior. Overhead line material including 81 tubular poles, 1,250 kilos of bare copper cable, 715 kilos of bare copper wire and 320 insulators. (A.X. 10891.)*

July 5th. Pumping equipment, installation of telephone system, &c., at Damietta. (G.X. 10369.)*

July 6th. 380 steel tubular poles, 2,000 kilos of bare copper wire, junction boxes and 695 meters. (A.X. 10907.)*

July 11th. Electric power station at Mansouah, including Diesel-driven alternators, switchgear, transformers, pumping sets, and a 40-ton crane. (A.X. 10910.)*

June 15th. Ministry of Public Works. Electrically-driven pumping plant for El Arisk. (G.X. 10370.)*

HONLEY.—May 19th. West Riding Education Committee. Installation of electric light at new Grammar School and caretaker's house. Particulars from the education officer, County Hall, Wakefield.

HULL.—Corporation Telephone Committee. Automatic table telephones. (See this issue.)

KEARSLEY.—May 19th. Urban District Council. Electric wiring installation in 50 houses on the Springfield Road estate. Specification and form of tender (deposit £2) from Mr. E. Shaw, surveyor to the U.D.C., Council offices.

LONDON.—Central Electricity Board.—May 27th. Site works, foundation works, and buildings at Northampton, Ironbridge, Wolverhampton, Stafford, and Stoke-on-Trent for Central England Electricity Scheme. (April 24th.)

NEWCASTLE-UNDER-LYME.—June 2nd. Electricity Supply Department. Transformers, switch cubicles, metering equipment, &c. (May 8th.)

NEW ZEALAND.—July 2nd. Government railways. 60-kVA static condenser. (A.X. 10898.)*

NORTH-WEST MIDLANDS.—Joint Electricity Authority. Steam raising fuel, painting work, &c. (See this issue.)

SOUTH AFRICA.—Port Elizabeth.—May 28th. Municipal Council. Materials and constructional work in connection with circulating water scheme for power station. (G.X. 10364.)*

Johannesburg.—June 15th. Railways and Harbours. Oil engines, pump, compressors, &c., for Usakos Workshop. (G.X. 10368.)*

URUGUAY.—Montevideo.—May 27th. State Electricity Works. 200,000 m. of copper conductor wire and 97,500 m. of copper cording with rubber insulation. Particulars (35 francs) from Dr. Ricardo Vecino, 41, Avenue de L'Opéra, Paris. (A. 10887.)*

June 18th. Electrical accessories, including fuse wire, porcelain insulators and supports, lever switches, rotary switches, cut-outs, plugs and sockets, seamless steel conduit, ebonite tubing and lamp holders. (A.X. 10908.)*

WEST MIDLANDS.—June 1st. Joint Electricity Authority. Sub-station transformers. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

BARROW-IN-FURNESS.—Electricity Committee. Accepted:—
Supplies for period ending March 31st, 1932:—Meters.—Landis & Gyr, Ltd.; Ferranti, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Electric irons.—Premier Electric Heaters, Ltd.; Downes and Davies, Ltd.; W. R. Thornton, Ltd.

BIRKENHEAD.—Electricity Committee. Accepted:—
Transformers for Swan Hill sub-station (£307).—Metropolitan-Vickers Electrical Co., Ltd.
H.p. switchgear (£636).—General Electric Co., Ltd.
L.p. switchgear (£343).—English Electric Co., Ltd.

BRADFORD.—Electricity Committee. Accepted:—
"L" type travelling grate mechanical stokers, twin grate pattern, not exceeding four in number, to replace mechanical stokers now obsolete in No. 4 boiler house at Valley Road power station, with necessary auxiliary equipment (£28,786).—International Combustion, Ltd. The work is to be proceeded with from time to time as may be found convenient.
Education Committee. Accepted:—
Electric lighting of extension at College of Arts and Crafts (£379).—N. Walker.
Electric lighting of extension to Technical College (£889).—R. Higginbottom & Sons.
Both these tenders were the next lowest to those previously accepted and since withdrawn by the companies concerned.

CARLISLE.—Electricity Committee. Accepted:—
Three switchgear units (£372).—Ferguson, Pailin, Ltd.
Two switchboards (£152 each).—Switchgear & Cowans, Ltd.

DONCASTER.—Electricity and Tramways Committee. Accepted:—
E.h.p. switchgear, &c., for connection of the power station to the national Grid scheme (£7,821).—Metropolitan-Vickers Electrical Co., Ltd.

DURHAM.—County Council. Accepted:—
Electric lighting in schools:—Birtley (£192).—B. L. Oliver; Bishop Auckland (£82) and Bolden Colliery (£226).—Falconar Cross & Co., Ltd.; Castle Eden Colliery (£183).—Gray Bros.; Sunnybrow (£87) and West Stanley (£351).—Devereux, Moodie & Co., Ltd.; Waterhouse (£168).—R. Robson; Hetton-le-Hole (£62).—T. A. Taylor.

EAST HAM.—Electricity Committee. Recommended:—
Cable in the Green Street and Wanstead area (£2,817).—Enfield Cable Works, Ltd.

KIRKCALDY.—Corporation Health Committee. Accepted:—
Electrical fittings in new abattoir (£540).—James Scott & Co.

LONDON. — Holborn. — St.-George-the-Martyr trustees. Accepted:—
Electrical installation at non-provided school (£130).—Dunsbier & Rogers.

London County Council.—Education Committee. Recommended:—
Electric lighting fittings, telephones, &c., at extension of School of Printing, Lambeth (£3,734).—Electrical Installations, Ltd.
Accepted:—
Electric lighting at Hope Street school, Islington (£589), and Hackney Downs school (£540).—H. J. Cash & Co., Ltd.
Electric lighting at Balham and Tooting Commercial Evening Institute (£336).—Pinching & Walters.
Highways Committee. Accepted:—
Insulator clips.—R. A. Bradshaw & Son, Ltd.
Electric arc welding plant.—Equipment & Engineering Co., Ltd.
Electrodes.—Quasi Arc Co., Ltd.; Murex Welding Processes, Ltd.
Tramcar electrical equipments and magnetic brakes.—Metropolitan-Vickers Electrical Co., Ltd.
Repairs to steam rotor at Greenwich power station.—British Brown-Boveri, Ltd.

PLYMOUTH.—Electricity Committee. Accepted:—
E.h.p. switchgear (£11,350).—Metropolitan-Vickers Electrical Co., Ltd.
Reactors, metal core type (£1,396).—Crompton Parkinson, Ltd.
24 in. and 36 in. metal non-return valves (£203).—F. Bird and Co.

PORTSMOUTH.—Health Committee. Recommended:—
Electric food mixer for mental hospital (£110).—H. A. Evans, Ltd.
Electricity Committee. Recommended:—
Six transformer kiosks (£288 each).—English Electric Co., Ltd.
Two 500-kVA transformers with Scott tappings (£262 each).—Hackbridge Electric Construction Co., Ltd.
Two 500-kVA transformers (£167 each), and twelve 50-kVA transformers (£36 each).—Crompton Parkinson, Ltd.
Drainage Committee. Recommended:—
Electric lighting installation at sewage works (£570).—Alpha Manufacturing & Electrical Co., Ltd.

ROTHERHAM.—Electricity Committee. Recommended:—
Transformers for 12 months.—General Electric Co., Ltd.
Switchgear for 12 months.—A. Reyrolle & Co., Ltd.

SALFORD.—Transport Committee. Accepted:—
25 gear wheels (£207), and 50 pinion wheels (£53).—Metropolitan-Vickers Electrical Co., Ltd.
Electricity Committee. Accepted:—
Supplies required during the period May 1st, 1931, to March 31st, 1932:—Cable.—N.V. Nederlandsche Kabelfabriek, Delft; Derby Cables, Ltd.
L.p. box compound.—Berry, Wiggins & Co., Ltd.
E.h.p. and h.p. box compound.—Dussek Bitumen Co., Ltd.
Meters.—Thompson & Co.
Transformers.—British Electric Transformer Co., Ltd.
6,600-V metal-clad switch units.—Allen West & Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Motors.—Lancashire Dynamo & Motor Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Higgs Motors, Ltd.; Laurence Scott, & Electromotors, Ltd.
Cookers.—Credenda Conduits Co., Ltd.; Revo Electric Co., Ltd.; General Electric Co., Ltd.
Fires.—Hotpoint Electric Appliance Co., Ltd.; Carron Company.
Water heaters.—W. E. Beardsall & Co., Ltd.; Credenda Conduits Co., Ltd.; A. Low & Sons, Ltd.; Jackson Electric Stove Co., Ltd.
Hot water circulators.—Santon, Ltd.; Hedin, Ltd.
Wash boilers.—Samuel Simister & Co.
Rubber-insulated cable.—Mersey Cable Works, Ltd.
The city electrical engineer has been authorised to continue to order electric kettles from Premier Electric Heaters, Ltd., and to test kettles manufactured by the Credenda Conduits Co., Ltd., and the Revo Electric Co., Ltd.

SEAHAM.—Durham County Council. Accepted:—
Electric lighting at sanatorium extension (£720).—Law and Burns.

WAKEFIELD.—Housing Committee. Accepted:—
Wiring 150 houses in course of erection on the Eastmoor estate (£1,151).—Walter Robb, Ltd.

Forthcoming Events

INSTITUTION OF ELECTRICAL ENGINEERS.—*Western Centre.*—May 15th-18th. Summer meeting at Plymouth. *South-Midland Students' Section.*—Saturday, May 16th. 2.30 p.m. Visit to Mitchells & Butler's brewery, Cape Hill, Smethwick. *Mersey and North Wales (Liverpool) Centre.*—Wednesday, May 20th. Benevolent Fund golf competition. *Irish Centre.*—Thursday, May 21st. Trinity College, Dublin. 7.45 p.m. Annual general meeting. *London Students' Section.*—Friday, May 22nd. Institution, London. 6.15 p.m. Annual general meeting. *North Midland Students' Section.*—Wednesday, May 20th. Visit to the power station and works of Synthetic Ammonia and Nitrates, Ltd., Billingham.

CONFERENCE ON SAFETY IN MINES.—Saturday, May 16th. City Hall, Cardiff. Sessions, 11 a.m.-1.15 p.m., and 2.30 to 5 p.m. Chairman: Mr. E. Shinwell, M.P., Secretary for Mines.

ROYAL SOCIETY.—Wednesday, May 20th. Burlington House, Piccadilly, W. 8.30 p.m. Conversazione.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—Saturday, May 23rd. South Wales Institute of Engineers, Cardiff. 6 p.m. Annual meeting.

INSTITUTE OF PHYSICS.—Tuesday, May 19th. Institution of Electrical Engineers, London. 4.30 p.m. "Physics in Relation to the Development of the Internal Combustion Engine." Mr. A. E. L. Chorlton.

Our Service Department

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

"OSA-VITALUX" medical lamp for sunray treatment.
"BARDALE" water heater.
Rubber-covered test clips as used in accumulator charging.

Notes

The Electrical Engineers' Ball

The General Committee met on Monday last at the Institution of Electrical Engineers and voted £100 to be equally divided between the Institution of Electrical Engineers' Benevolent Fund and the Electrical Trades Benevolent Fund. The joint honorary secretaries, Messrs. A. M. Sillar and C. W. Hill, report that the dance held on February 13th proved as great a success as its predecessors, there being over 700 present.

Distribution Mains in Cork

Cork lies for the greater part below high-tide level and is frequently flooded. The original distribution network, designed for less trying conditions, was taken up, re-designed and re-laid by Mr. H. H. Nalder, the chief engineer and manager. Cork was the first place in which the diving bell principle was applied to underground disconnecting boxes, in which there are no joints, nuts, or bolts; it is only necessary to lift the lid. The boxes were designed to be watertight under 4 ft. of water. Single-pole boxes are used; hence there are no "shorts," and they are always safe to operate. They are made in the repair shops of the undertaking—a very important feature in a place such as Cork where there are no big firms across the road, and every emergency has to be tackled by the local staff.

Scrapping the Railways

Caustic comment is made in *Modern Transport* on the contention of Mr. F. A. Macquisten, K.C., M.P., that electrification will not save the railways, as they are obsolete. Mr. Macquisten suggested that the railways should "all be pulled up and their routes laid out as ferro-concrete motor roads, charging tolls for all commercial vehicles, which would take out tickets at the points of ingress and give up same at their exits on the highway . . . . On the comparatively straight and unobstructed routes of the railways, motors could run with equal safety in less time, and with such frequency and lower charges as greatly to stimulate traffic and distribute population." *Modern Transport* remarks that it is a picture before which the brain of any quite ordinary kind of person might reel. For, once managing to fight a way through the congested streets to the ticket office at the point of ingress, millions of tons of coal and an equally modest quantity of mineral and other traffic could proceed along those straight and unobstructed routes in stimulating pomp, thus ensuring that the trainless and neglected population—and anything else which might manage to get in the way—should be well and truly distributed in all directions according to Mr. McQuisten's plan. After that, it would merely be necessary to hang about in a queue for a few hours in order to "give up same at the exit," when all could proceed to their particular destinations—again according to plan.

Electric Cooking for All

In order to refute a widely-held idea that electric cooking is a luxury that can only be indulged in by wealthy people, the Association of Electric Power Stations in the Swiss canton of Zurich has recently made an analysis which reveals the fact that out of 2,610 households in which cooking is entirely done by electricity, 680 families, or 26 per cent. of the total, were those of workmen, 307, or 12 per cent., those of country folk, and 790, or 30 per cent., those of clerks and other employés.

A Mercury-vapour Detector

After a year of practically continuous operation, the mercury boiler at the South Meadow station of the Hartford Electric Light Co., U.S.A., has been shut down for retubing. The immediate cause of taking the unit out of service is stated by *Power* to be the development of a slight leak in one of the tubes, accompanied by some bulging in others. Detection of the leak was almost instantaneous by the selenium-sulphide-coated ribbon which, in combination with a photo-electric cell, sounds an alarm if any mercury vapour is present in the flue gases. So sensitive is this detector that it will indicate when two cubic centimeters of mercury is thrown into the furnace with the boiler under full load. Investigation has shown that mercury had nothing whatever to do with causing the leak, but that it was brought about solely through failure of a small mechanical detail.

Appointments Vacant

Chief engineer and manager for the Oxford Corporation electricity undertaking.

Electrical engineer and manager for Bacup Corporation.

Mains assistant for Southport Electricity Department.

Showroom assistant for the Mid-Cheshire Electricity Supply Co., Ltd.

(See our advertisement pages to-day.)

Sunlight Treatment

That the Institute of Ray Therapy, London, which was opened last year to provide artificial sunlight treatment, is fulfilling a want is shown by the fact that 553 doctors have sent patients to it. An average of more than 4,000 treatments a month has been maintained and more than 40,000 attendances have been recorded during the year. Rheumatism, asthma, bronchitis, skin diseases, and children's ailments are among the chief affections treated.

Generation of Electricity

The official returns rendered to the Electricity Commissioners show that 867 million kWh were generated by authorised undertakers in Great Britain during the month of April, 1931, as compared with the finally revised figure of 849 million kWh in the corresponding month of 1930, or an increase of 2.1 per cent.

During the first four months of 1931 up to the end of April the total amount of electricity generated by authorised undertakers was 4,052 million kWh as compared with the finally revised figure of 3,880 million kWh for the corresponding period of 1930, representing an increase of 4.4 per cent.

Figures on a quarterly basis for the years 1924 to 1927 have been prepared, and are embodied in the table below together with a summary, on a quarterly basis, of the figures already published for the years 1928 to 1930.

Quarter.	Millions of kWh generated. 1924. M.	1925. M.	1926. M.	1927. M.	1928. M.	1929. M.	1930. M.	1931. M.
Jan.—March ...	1,664	1,708	1,992	2,200	2,472	2,844	3,031	3,185
April—June ...	1,347	1,430	1,459	1,760	1,994	2,254	2,390	—
July—Sept. ...	1,331	1,453	1,458	1,814	1,929	2,193	2,341	—
Oct.—Dec. ...	1,752	1,984	2,131	2,460	2,678	3,003	3,152	—
Year ...	6,094	6,665	7,040	8,234	9,073	10,294	10,914	—

It will be noted that in each of the years subsequent to 1924, the output (kWh generated) in every quarter showed an increase over the output in the corresponding quarter of the preceding year.

The particulars given above are inclusive of certain cases where stations belonging to companies other than authorised undertakers are leased to or operated by company undertakers and utilised for the purpose of their undertakings.

The sum of the quarterly figures, based on monthly returns, shows a slight variation from the finally revised annual figures subsequently published.

Bingley Showrooms Inquiry

An inquiry was held at Bingley (Yorks.), on May 8th, by Mr. H. Nimmo, chief engineering inspector for the Electricity Commissioners, into the Urban District Council's scheme to convert shop property in Main Street into offices and showrooms for the Electricity Department. The scheme was opposed by a number of local bodies and some of the members of the Council. The chief objections were that the undertaking would become a charge on the rates, the proposed building would have to be pulled down before long for street widening, and that showrooms should be combined with the existing gas showrooms. Evidence given in support of the scheme showed that the growth of the Electricity Department had exceeded all expectations, and figures were given showing that the showrooms would not become a charge upon the rates.

Lighting with Shadows

In the printing room of the National Institute for the Blind the use of braille type is almost impossible without the existence of shadows to throw up the raised lettering in relief, and a lighting installation to fulfil these requirements is being carried out. The mounting and spacing are accurately planned to give precise and efficient illumination, and at the same time to provide the light shadows essential to this type of work. In addition to this specialised section, the National Institute is effecting a change-over from the existing conical shades to high-efficiency reflectors, and a marked appreciation of the resulting benefits is being expressed by the staff. A point of interest is that the entire change-over is taking place without any increase in current consumption. The installation is being carried out by the Benjamin Electric, Ltd.

The Post Office and the Faraday Centenary

We noticed a day or two ago a post-card franked "Faraday Centenary Celebrations, September, 1931." The Post Office is so often regarded as a legitimate scape-goat that it is with pleasure we record this touch of imagination on the part of the authorities. After all the Post Office owes as much to Faraday as any other body in the electrical industry and it has given a president to the Institution of Electrical Engineers no later than 1929-30.

A Floating Power Station

The electric light and power company at Baudjermasin, in the Dutch East Indies, has recently solved the problem of extending the capacity of its plant in an unusual way. Owing to the marshy nature of the land, the Dutch Colonial authorities would not consent to an extension of the existing station. Of the two alternatives, that of erecting another station some distance away, or of mounting the additional plant on a floating pontoon, the latter method was eventually regarded as being the most convenient and the less costly. The floating pontoon, which is of steel construction with towing equipment at each end, is 82 ft. long and 26½ ft. in width. The generating plant is located in a steel erection on the pontoon deck, and consists of Sulzer-Diesel, six-cylinder, four-cycle engine and generator developing 600 h.p. at 250 r.p.m. The engine is water-cooled by a small centrifugal pump fitted on the end of the main crankshaft, which raises water to an overhead tank from which it flows by gravity to the cylinder jackets. Large fuel tanks are located below the pontoon deck, while the electricity generated is transmitted by a cable held in position by floats to the switchboard in the land station; in this way only one man is required to look after the floating station.

I.E.E. Wireless Section Committee

The Committee of the Wireless Section of the Institution of Electrical Engineers has nominated the following members to fill vacancies which will occur by retirement on October 1st next:—Chairman: Col. A. S. Angwin; vice-chairman: Mr. L. B. Turner; new members of committee: Prof. J. T. MacGregor-Morris and Messrs. H. Faulkner, W. J. Picken and T. Wadsworth.

Supply at Burnham-on-Crouch

The County of London Electric Supply Co., Ltd., inaugurated the first supply of electricity to Burnham-on-Crouch, Essex, on Monday last at 12.30 noon, when Mr.

Sadler, chairman of the Burnham-on-Crouch Urban District Council, switched on the current. This is part of the programme of this company for the electrification of rural Essex, which is proceeding steadily.

Railway Electrification and Cost of Electricity

At the annual dinner of the Iron and Steel Institute, reported in the *Daily Telegraph*, Sir Hugo Hirst, Bart., said that if the scheme for the electrification of the railways was ever carried out, it would mean that electricity in this country would be cheaper than anywhere else in the world.

Lord Weir referred to the constitution of the Central Electricity Board which, he said, represented the most advanced modern development of State-nominated control. He did not disclaim a measure of responsibility for this; indeed, he was proud of it. Nevertheless it would be a dangerous hallucination to suppose that it would be possible to constitute a similar body to deal with the grim situation of steel or cotton.

Monel Metal

The selection of a metal capable of withstanding high temperatures is a matter of paramount importance, Monel metal is a material which fulfils all that is demanded, it has also a wide field where corrosion resistance coupled with good mechanical properties are required. Special properties of Monel metal are, that it will not rust, is inherently tougher and stronger than mild steel, and is highly resistant to atmospheric corrosion.

The mechanical properties of cold-drawn "Strain" annealed rods, in which form it is usually supplied, are: Ultimate breaking strength, 43 tons per sq. in.; yield point, 35 tons per sq. in.; elongation, 20 per cent.; the cold-drawn rod can be produced to fine limits of accuracy. In the design of outdoor switchgear and transmission fittings considerable use will be found for this metal, such as for hinge pins which will not rust up, and bolts that can always be unbolted. For high-pressure steam work, coupled with high temperatures, such parts as valves, valve seats, spindles ,and corrugated joint rings are highly efficient, while for pump work, especially where the corrosion resistance property is of value, the pump rods may be made of Monel. Monel consists of approximately 68 per cent. nickel, 29 per cent. copper, and the remainder chiefly manganese and iron; it is a natural alloy and can be rolled, drawn, cast, forged, soldered, and acetylene welded. Physical properties are: Melting point, 1,360 deg. C.; weight of 1 cu. in., 0.323 lb.; electrical conductivity, 5 per cent. that of copper; shrinkage allowance for castings, ¼ in. per foot.—H. E. HUTTER.

Educational

THE ARMOURERS & BRASIERS COMPANY, London.—A course of three lectures in metallurgy is to be given at the Royal School of Mines, South Kensington, and at King's College, Strand.

(See our advertisement pages to-day.)

MANCHESTER MUNICIPAL COLLEGE OF TECHNOLOGY.—Summer evening short courses, including electrical engineering, will commence on June 1st and 2nd, and will continue until July 21st.

Vehicle Headlamps

It is understood that dipping lamps, or, alternatively, lamps that can be swung sideways, will very shortly be made compulsory on every motor vehicle. The Minister of Transport, as the result of representations made to him and in pursuance of his "safety first" policy, has issued draft regulations on the subject of dazzle headlights. They will embody a principle and not a particular device and there is also likely to be a restriction on the power of headlamps. It has been suggested to the Minister that the 36-watt lamp is the ideal. The new regulations are tentative and are to become effective in October, 1932.

Soldering by Electricity

Soldering irons are, since the coming of the wireless enthusiast, a necessity in any amateur workshop. Until recently they have been dear, but increasing demand has brought the price down very considerably. A better proposition is a small heater, similar to that suggested for curling tongs. In fact the same heater will do both jobs. The advantage is that any type of small soldering bolt can be put into the heater, whereas it is sometimes a nuisance to change the bits on a bolt which has a screwed head for the purpose. After a time the bit becomes difficult to remove, and again when two or more different bits are required at one time changes are rather troublesome.

The First Electric Train at Altrincham

We took some photographs of the first electric train to arrive at Altrincham last Monday and reproduce two herewith. An

account of the railway appears in this issue on page 827 and also in the issue of January 23rd, 1931.

The Acton Platinum Refinery

The British Empire is fortunate in its resources of precious metals and recently there has been added a considerable output of metals of the platinum group. One of the most important deposits of these metals (platinum, palladium, iridium, rhodium, ruthenium and osmium) occurs with a sulphide of iron, copper, and nickel in the extensive nickel-copper ore region of Ontario, which ore is worked primarily for the production of nickel, the demand for which has become so large that, when working at full capacity, the output of platinum metals will reach 300,000 ounces per annum; world consumption is certainly less than 400,000 ounces. Since the fusion of the interests of the International Nickel Company, Inc., and the Mond Nickel Company, Ltd. (to form the International Nickel Company of Canada, Ltd.) the treatment of concentrates from the electrolytic nickel refinery at Port Colborne, in Ontario, has been undertaken at Acton, London, which refinery has recently been considerably enlarged. The assay, chemical, and electrolytic laboratories are conducted on a production scale, both gold and silver being purified by electrolysis, apart from research work which is carried on there. The uses of platinum include electrodes, wire, and other laboratory equipment. In the form of an alloy with 10 to 25 per cent. of iridium, it is extensively used for contact points in magnetos, electrical control and telephone apparatus, power switches, thermostats, electric clocks and other equipment in which absolute reliability is required. Other electrical uses include thermo-elements for high-temperature work, and resistors for electric furnaces operating at temperatures up to 1,200 deg. C.

Endothermic "Knife" Temperature

The active electrode employed by surgeons for cutting with high-frequency currents varies in shape, but is of small dimensions, since the action of the "knife" depends on high current density and the formation of a minute electric arc. The very-high-frequency undamped current used (generated by valves or multiple spark-gaps) produce remarkable alterations in the structure of animal tissue cells without charring, but the physical characteristics of the h.f. apparatus which determine the efficacy of the cut are still obscure. Though the cutting is effected by the arc, some knowledge of the temperature of the "knife" (or guiding electrode) is desirable and has been investigated by Miss Mary D. Waller, lecturer in physics at the London (Royal Free Hospital) School of Medicine for Women. According to the *British Journal of Radiology*, a thermo-couple was formed by welding fine gold (36 s.w.g.) to the copper needle electrode of a Wappler Wyeth endotherm, the junction being not more than 0.5 mm. from the tip of the needle and connected to a moving-coil galvanometer. The specimens were placed on a large inactive electrode, contact being made with lint soaked in a salt solution, and the cutting was continued until the deflection of the galvanometer reached the maximum. The experiments were the first to indicate the temperature of the cutting needle, which is of the order of 50 to 400 deg. C., according to the nature of the cutting.

The Prince and Foreign Trade

The Prince of Wales is not resting after his recent activities in South America; from the knowledge which he gained during his tour he has this week been telling the commercial community where they are lacking in trade with South America and what they must do if they are to maintain or improve their position in these growing markets. While much of what he has said is not new, it has acquired a new value by coming from such a source. Addressing members of the Birmingham Chamber of Commerce at a dinner on Monday evening, he said that his visit to South America was prompted by a desire to do something for the country in this time of serious depression. The situation had not improved in the meantime, and his object in addressing them was to pool his experiences with theirs in an endeavour to see how British trade with South America could be maintained, and what preparations should be made to enable every advantage to be taken of the revival when it came. He had made a point of talking freely with representatives of British trade in the countries which he had visited and, as a result, claimed to know of all their troubles and difficulties. In his previous investigations of our overseas trade he had been mainly to Empire countries where there existed a natural desire to place Great Britain before her foreign competitors. In South America we possessed no such advantage, and we had to compete in an open market. He had, therefore, been able to see ourselves as others saw us.

Electric Light at Hatfield House

There have been appearing in recent issues of *The Times* special articles extracted from Vol. III of the "Life of Lord Salisbury" by Lady Gwendolen Cecil, to be published shortly by Hodder & Stoughton. The articles, which begin when Lord Salisbury is living in retirement after the fall of the Conservative Government in 1880, contain the following interesting reference to the first private house electric lighting installation:—

"At the time that he left office the invention of the incandescent lamp, by which electric lighting was at length con-

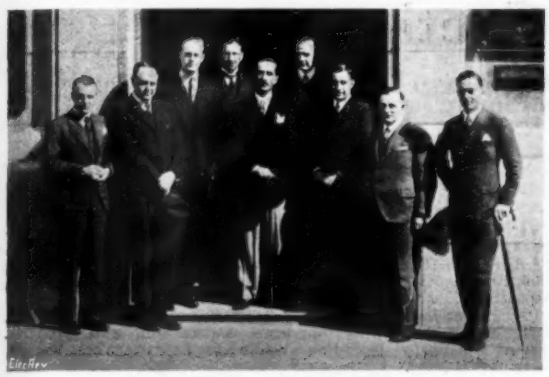
trolled to practical usefulness, had just been announced. Lord Salisbury had been for some time impatient for the development. He had erected some Jablokhoff arc lights outside his house at Hatfield—mainly for the benefit of his guests' coachmen on the occasion of the annual county ball—and he had tried to introduce it into the interior. For a brief period his family and guests were compelled to eat their dinners under the vibrating glare of one of these lamps fixed in the centre of the dining-hall ceiling. No exertion of goodwill or courtesy could silence the plaintive protests of his lady visitors, and he would gird with growing despondency at the obstruction which feminine vanity offered to the conquests of science. He was saved from humiliating defeat by the timely appearance of the Edison-Swan lamp. No expert middleman had as yet undertaken the installation of the new invention. It was an opportunity for independent action under conditions which were so untried as to have all the charm of scientific experiment, and Lord Salisbury did not miss it. He set his estate workmen to the task that winter, under the direction of a sympathetic clerk of the works who shared his employer's taste for new ideas, and in the following summer Hatfield was able to contest with Craigside the honour of being the first private house in England in which the new light was established."

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. James Davies, of the Leicestershire and Warwickshire Power Co., and **Miss Kathleen Davis,** cookery demonstrator at the company's showrooms at Old Hill, who were recently married, have been presented by the power station staff with an electric fire and an iron, and by the staff of the company at Borough House with a silver tea tray.

The central figure in the group depicted below is **H.H. Field Marshal Shah Walli Khan,** brother of the King of Afghanistan. He is seen with members of his staff and some of the officials of British Insulated Cables, Ltd., upon the occasion of his visit to the company's Prescot works recently. His Highness is representing the Afghanistan Government in this country.



An Afghan Prince at the B.I. Works

Mrs. Ida Bentley has accepted the post of hon. secretary of the Halifax branch of the Electrical Association for Women vacated by Mrs. Rendell-Baker on her husband, late borough electrical engineer, leaving the district to go to Croydon.

Mr. H. A. Lingard

Mr. H. A. Lingard, who, as announced in our last issue, has just been appointed a director of the British Thomson - Houston Co., Ltd., first entered the service of the company in 1904 in the turbine works at Rugby. In 1915 he joined the Export Department. For the last three years Mr. Lingard has been general manager of the "Mazda" Lamp Sales Department, in which capacity he has become very widely known throughout the commercial section of the electrical industry.

Commander C. W. Craven, R.N., has been appointed to be managing director of all works and shipyards of Vickers-Armstrongs, Ltd.

Mr. S. H. Fowles, borough electrical engineer of Loughborough, has been granted an increase in salary raising it from £750 to £850, with a further rise to £950 in a year's time. Mr. Fowles was recently on the short list for the position of borough electrical engineer of Halifax.

Mr. T. V. Greenwood, of the staff of the Hebden Bridge electricity works, who was recently married, has been presented by his colleagues with a clock.

Mr. Eric Davies, managing director of Messrs. Hubert Davies & Co., Ltd., a South African company which carries out electrical and general engineering contracts on a large scale, has arrived on a six months' visit to this country. The company's London office is at 586, Salisbury House, London Wall, E.C.2.

Mr. T. D. Martin, who is leaving South Shields to become borough electrical engineer of Nelson, was presented last week with a grandmother clock by the staff of the South Shields Electricity Department.

The Council of the Institute of Transport has elected the following to take office on October 1st:—*President:* Mr. Frank Pick, managing director of the "Underground" Group. *Past Presidents to serve on the Council:* Sir Henry P. Maybury, Sir Joseph Nall, Mr. Roger T. Smith, Sir Josiah Stamp, and Sir Arthur Stanley. *Vice-Presidents:* Mr. A. L. Barber, Mr. R. Bell, Mr. J. H. Follows, Mr. R. J. Howley, Major-General S. S. Long, and Sir David J. Owen. *Hon. Treasurer:* Sir Henry P. Maybury. *Hon. Librarian:* Mr. W. V. Wood.

Mr. B. A. Martin Cooper, M.I.E.E., A.M.Inst.C.E., who has been appointed H.M. Electrical Inspector of Factories for the Yorkshire Division, with headquarters at Leeds, received his elecrical engineering training at the City & Guilds College, Kensington, and was subsequently with the Bournemouth Corporation tramways, Bournemouth and Poole Electric Supply Co., Newcastle Electric Supply Co., Ltd., Yorkshire Electric Power Co., and the Blackburn and Worcester Electricity Departments. Last week the staff of the Worcester Electricity Department presented him with an electro-plate tea set upon his departure.

A dinner is to be given in honour of **Sir Josiah Stamp** for his services in promoting the application of economic science to practical affairs, on June 11th, at Park Lane Hotel. It will be attended by leading representatives of industry, science, and education.

Mr. W. T. Walker has been appointed to the board of the Ever Ready Co. (Great Britain), Ltd.

Obituary

Mr. G. Fuller.—The death of Mr. George Fuller, M.I.E.E., which was recorded here last week, severs one of the last links with the electrical pioneers of the middle of the last century. He had reached the advanced age of 85 years and his name is known in all parts of the world in connection with electrical batteries; his interests and activities, however, covered a very much larger field. Starting work in his 'teens in about 1860, he joined Messrs. S. W. Silver & Co., now known as the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., of Silvertown, and worked there with his father for a number of years. It was while he was there that the necessity for an efficient battery for electric telegraphy was recognised; his efforts were, therefore, directed to the improvement of existing types and assisting his father in experimental work in primary batteries. Before founding their own company of John C. Fuller & Son, at Bow, E., in 1875, Mr. Fuller spent a number of years with Mr. W. T. Henley who was at that time the chief manufacturer of electrical apparatus. From the beginning the Fuller business was a success, largely owing to the invention of the Fuller mercury bichromate battery which fulfilled the want already mentioned and was adopted by the Post Office, telegraph, railway, and cable companies, and for many years afterwards was extensively used throughout the world. His other activities embraced the design and manufacture of telegraph apparatus, wire and cables, accumulators, insulators, and later, with the advent of the internal combustion engine, magnetos and other ignition equipment. As a result of research work in accumulators, Mr. Fuller, in 1912, formed the Fuller Accumulator Co., and chiefly through the introduction of the Fuller block accumulator, the company expanded rapidly, so much so that in 1915 they had to move their factory from Bow to Chadwell Heath where there was more room for expansion

The late Mr. George Fuller, M.I.E.E.

In addition, Mr. George Fuller started Fuller's Wire and Cable Co., Ltd., and Fuller's Carbon and Electrical Co., Ltd., all of which amalgamated in 1920 under the title of Fuller's United Electric Works. Before his retirement in 1923 he employed upwards of 1,000 people. Mr. Fuller spent the last eight years of his life in retirement, chiefly gratifying his artistic and musical tastes. Both in the Fuller Accumulator Company (1926), Ltd., and elsewhere, he leaves many friends to regret his loss. His own early struggles gave him a solicitude for the well-being of those who were associated with him in his various undertakings, and it is noteworthy that the improvement of factory conditions was one of his constant aims.

Provost D. Jones.—The death occurred recently at Kilmarnock, in his 70th year, of Provost David Jones. He had been a member of the Kilmarnock Town Council for 23 years and was a member of the Ayrshire Electricity Board.

Mr. W. Bolton.—The death occurred on May 4th at his residence, South View, Rake Lane, Eastham, of Mr. Walter Bolton, formerly superintendent at Liverpool to the Eastern Telegraph Co., Ltd.

Mr. A. L. Gray.—The death has taken place at Herne Bay, where he had resided for the past twelve years, of Mr. Archibald Louis Gray, who was associated with the business of Siemens Electric Lamps & Supplies, Ltd. He was 55 years of age.

Will.—Mr. William H. Brown, former secretary of the Metropolitan Railway, left estate valued at £20,903.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Midland Electric Installation Co., Ltd.—Private company. Registered May 6th. Capital, £10,000 in £1 shares. Objects: To acquire the business of an electrical engineer carried on by H. Joseph as the "Midland Electrical Power Installation Co.," at Old Mill Street, Wolverhampton. The directors are: H. Joseph, Old Mill Street, Wolverhampton, electrical engineer, and J. M. Hollander, 55, Portland Road, Edgbaston, Birmingham, electrical engineer. Solicitors: Philip Cohen, Slater & Tompkins, 47, Newhall Street, Birmingham.

A. R. Camidge & Co., Ltd.—Private company. Registered May 6th. Capital, £2,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in dynamos, motors, armatures, magnetos, batteries, &c. The subscribers (each with one share) are: F. A. Jones, 76, Boundaries Road, S.W.12, solicitor's clerk, and G. D. Pagnam, Lloyds Bank Buildings, Moorgate, E.C.2, solicitor's clerk. The first directors are to be appointed by the subscribers. Registered office: 2, Grove Lane, Stamford Hill, N.16.

Irish Radio Publicity Co., Ltd.—Private company. Registered in Dublin on May 1st. Capital, £1,000 in £1 shares. Objects: To carry on the business of dealers in wireless, electrical and telegraph apparatus, &c. The directors are: C. F. Russell, 46, Frankfort Avenue, Rathgar, Dublin, aviator, and C. E. McConnell, 10, Pearse Street, Dublin, company director.

Factodoor, Ltd.—Private company. Registered May 6th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in all kinds of apparatus for the reception and transmission of wireless messages, speeches and musical programmes, &c. The directors are: B. Hackett, 46, Saltesford, Warwick, and H. Roberts, 64, Newburgh Crescent, Warwick. Registered office: 118, Warwick Street, Royal Leamington Spa.

Ward Electrical Co., Ltd.—Private company. Registered May 8th. Capital, £100 in 1,800 founders' shares of 1s. each and 10 ordinary shares of £1 each. Objects: To carry on the business of electrical engineers and contractors, carried on by J. Holder and H. Fuller, at 155, Wardour Street, W. The directors are: B. M. Hickman, 79, Woodlands, N.W.11; J. Holder, 32, Nassau Road, S.W.13; H. Fuller, 19, Egerton Road, N.16. Secretary: J. Holder.

Quartz Radio, Ltd.—Private company. Registered May 2nd. Capital, £4,500 in £1 shares. Objects: To carry on business as workers in and cutters or grinders of quartz or other crystals, manufacturers and sellers of and agents for wireless sets, parts or components, &c. The subscribers (each with one share) are:—W. Rix, 11, Torridge Road, Thornton Heath, managing clerk; and Mrs. Madge W. Furneaux, 76, Norfolk House Road, Streatham, S.W.16. The first directors are to be appointed by the subscribers. Solicitors: Garton & Co., 21, Maddox Street, W.1.

Edgar Backhouse, Ltd.—Private company. Registered April 29th. Capital, £1,500 in £1 shares. Objects: To acquire the business of a radio and electrical engineer and contractor carried on by E. Backhouse at Albert Road, Morecambe. The directors are:—E. Backhouse, 21, Westminster Road, Morecambe, electrical engineer (permanent managing director); and Mrs. Ellen Backhouse, 21, Westminster Road, Morecambe. Registered office: Albert Road, Morecambe, Lancs.

Allen & Welsby, Ltd.—Private company. Registered April 29th. Capital, £1,500 in £1 shares. Objects: To carry on the business of suppliers of electricity, electrical and mechanical engineers and contractors, &c. The directors are:—E. Allen, 7, Bolton Road, Walkden; and F. Welsby, 18, Gower Street, Walkden. Registered office: 7, Bolton Road, Walkden, near Manchester.

Electrical Power Developments (Western), Ltd.—Private company. Registered May 2nd. Capital, £5,000 in £1 shares. Objects: To carry on the business of electrical, mechanical, wireless, telephone, lighting, heating, motor and general engineers, engineering contractors, manufacturers and workers of and dealers in electricity, motive power and light, electrical installation contractors, &c. The first directors are:—A. C. MacWhirter, Wharf Street, Cardiff, electrical engineer; C. A. Smiles, The Hollies, Heath Park Avenue, Cardiff, electrical engineer; C. E. Hider, Gower Chambers, Gower Street, Swansea; and J. Auckland, Glyncoed, Penciseley Road, Cardiff. Solicitors: Macintosh, Thomas & Co., 8, St. John's Square, Cardiff.

Official Returns of Electrical Companies

Veritys, Ltd.—Satisfaction to the extent of £5,496 on December 31st, 1930, of debenture stock secured by trust deed dated October 31st, 1908, and supplemental trust deed dated May 17th, 1909, and registered November 20th, 1908, and June 7th, 1909, respectively. (Notice filed April 28th, 1931.)

Particulars filed of £60,000 debentures, authorised April 13th, 1931, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

English Electric Co., Ltd.—Satisfaction to the extent of £10,100 on December 18th, 1930, of debentures secured by trust deed dated September 15th, 1919, and registered October 3rd, 1919. (According to the register of mortgages, the trust deed registered October 3rd, 1919, originally secured £1,000,000.)

Electrical & Radio Products, Ltd.—Issue on April 27th, 1931, of £1,000 debentures, part of a series already registered.

County of Durham Electrical Power Distribution Co., Ltd.—Satisfaction to the extent of £250,000 on various dates between July 9th, 1930, and March 27th, 1931, of debenture stock secured by trust deed dated December 9th, 1907, and registered December 28th, 1907. (The power to issue a further £250,000 debenture stock conferred by the trust deed has never been exercised.)

J. V. Brittain & Co., Ltd.—Capital, £1,100 in £1 shares. Return dated December 17th, 1930. All shares taken up. £885 paid, £215 considered as paid. Mortgages and charges, nil.

White, Jacoby & Company, Ltd.—Capital, £7,500 in £1 shares. Return dated January 12th, 1931. 5,794 shares taken up. £3,437 paid, £2,357 considered as paid. Mortgages and charges: £1,500.

Santon, Ltd.—Capital, £4,000 in £1 shares. Return dated December 27th, 1930 (filed April 11th, 1931). All shares taken up. £2 paid, £3,998 considered as paid. Mortgages and charges: £3,200.

Lancashire Telephone Systems, Ltd.—Capital, £10,000 in 5,000 preference and 5,000 ordinary shares of £1. Return dated January 14th, 1931. 700 preference and 5,000 ordinary shares taken up. £5,080 paid on 700 preference and 4,380 ordinary shares, £620 considered as paid on 620 ordinary shares. Mortgages and charges: £1,650.

Mackallen Heating Co., Ltd.—Capital, £99 in £1 shares. Return dated January 6th, 1931. All shares taken up. £99 paid. Mortgages and charges, nil.

Anchor Cable Company, Ltd.—Capital, £250,000 in £10 shares. Return dated June 12th, 1930 (filed February 11th, 1931). 19,500 shares taken up. £61,000 paid, £134,000 considered as paid. Mortgages and charges: £50,000.

Electro Mechanical Supplies, Ltd.—Capital, £3,000 in £1 shares. Return dated January 14th, 1931. 999 shares taken up. £999 paid. Mortgages and charges, nil.

Johnson & Tanner, Ltd.—Mortgage on premises at Worcester Park, Surrey, dated May 5th, 1931, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., not exceeding £300.

Triotron Radio Co., Ltd.—Debenture dated April 15th, 1931, to secure £50,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Josef Leygraaf and Jacques Leygraaf, both of Venlo Hamburgersingel 1, Holland.

R. C. Seal & Co., Ltd.—C. F. Farmery, of Danes Inn House, 265, Strand, W.C.2, was appointed receiver and manager on April 28th, 1931, under powers contained in debenture dated April 20th, 1931.

J. Briggs Electrical Contractors, Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1930. 4,702 shares taken up. £4,702 paid. Mortgages and charges, nil.

Mann, Egerton & Co., Ltd.—Capital, £370,925 1s. in 250,000 preference and 85,389 ordinary shares of £1 and 64,611 ordinary shares of 11s. each. Return dated January 5th, 1931. 210,415 preference and 64,611 ordinary shares taken up. £205,045 paid on 191,434 preference and 13,611 ordinary shares. £47,031 considered as paid on 18,981 preference and 51,000 ordinary shares. Mortgages and charges: £39,032.

Stelmar Projection Lighting, Ltd.—Capital, £15,000 in £1 shares. Return dated January 5th, 1931. 12,545 shares taken up. £7,481 10s. paid on 7,545 shares, leaving £63 10s. in arrears, £5,000 considered as paid on 5,000 shares. Mortgages and charges, nil.

Set-a-lite & Accessories, Ltd.—Capital, £500 in £1 shares. Return dated February 26th, 1931. All shares taken up. £467 paid, £33 considered as paid. Mortgages and charges, nil.

Wilkins Electrical Works, Ltd.—Capital, £1,000 in £1 shares. Return dated January 14th, 1931. 685 shares taken up. £60 paid, £625 considered as paid. Mortgages and charges, nil.

Perfect Burglar Alarm Co., Ltd.—Capital, £4,000 in 1,000 preference and 3,000 ordinary shares of £1 each. Return dated December 31st, 1930. 230 preference and 1,710 ordinary shares taken up. £1,382 10s. paid (being £1 per share on 1,210 ordinary and 15s. per share on 230 preference shares), £500 considered as paid on 500 ordinary shares. Mortgages and charges, nil.

Electro-Metals, Ltd.—Capital, £30,000 in 4,000 preference shares of £5 and 10,000 ordinary shares of £1 each. Return dated December 31st, 1930 (filed March 5th, 1931). 102 preference and 10,000 ordinary shares taken up. £510 paid on the preference shares, £10,000 considered as paid on the ordinary shares. Mortgages and charges, nil.

P. Goddard & Co., Ltd.—C. A. Sandon, C.A., of 1a, Sloane Court, Sloane Square, S.W.3, ceased to act as receiver on April 27th, 1931.

Rowland's Electrical Accessories, Ltd.—Debenture dated April 28th, 1931, to secure £2,260, charged on the company's undertaking and property, present and future, including uncalled capital (if any) and goodwill. Holder: T. M. Adie, "Eymbister," Lanchester Road, Highgate, N.6. Also debenture dated May 1st, 1931, to secure £1,500, charged on the company's undertaking and property, present and future, including uncalled capital (if any) and goodwill (subject to the above debenture). Holders: Barclay's Bank, Ltd.

City Notes

Brush Electrical Engineering Co., Ltd.

The accounts of this company were abstracted in our last issue, p. 802, and the annual meeting was held on May 11th. Lord Vaux of Harrowden, who presided, before reviewing the accounts, referred to the loss the company had sustained by the death of Mr. Emile Garcke. Turning to the accounts, he directed the attention of the stockholders to the strong financial position disclosed by the balance sheet, and said that although the profit and loss account could not be regarded as satisfactory, the products of the company continued to maintain their high reputation and developments were in hand which should enable them to take advantage of any improvement in general trading conditions. The reduced profits were largely due to the fact that the engineering department had been far from fully occupied, having been seriously affected by the severe restriction of orders for generating plant. Many of the power stations, which would normally require Brush-Ljungstrom plant for extensions, had been precluded from placing orders as they would soon be taking bulk supplies from the national "grid." Although the Brush-Ljungstrom turbo-generator plant offered special advantages in the largest sizes, the company was not ready to undertake the manufacture of the 50,000/60,000-kW units until the end of the year. In order to meet the special conditions involved in the case of small industrial plants, it was also considered desirable to develop a line of geared turbines. The company was thus prepared, when the demand returned, to supply both the very large and the small plants, as well as those medium sizes which had been the principal product of the engineering department in the past. The rolling stock department had been well occupied throughout the year, although prices had on the whole been far from remunerative. The company carried a larger stock of timber undergoing natural seasoning than any other firm engaged in the same class of business. It was impossible to reduce quality in order meet low prices without lowering general standards of production, and this they had consistently refused to do. The tramcar contracts undertaken during the year included 100 tramcars and trucks for Leeds Corporation, 40 tramcars for Belfast Corporation, and smaller numbers for Coventry, Dundee, West Ham and Caracas. They also received important orders for single- and double-deck omnibus bodies and during the year they had developed an electric trolley omnibus to meet the expanding market for this class of vehicle. A sample 'bus had been in operation for some months with very satisfactory results. The transformer department had also been fully occupied during the year, although this business was very highly competitive. Considerable extensions were now in progress which would facilitate the manufacture of much larger sizes. It was a matter of regret that for the first time since its inception there was no distributable surplus for co-partnership scheme. The scheme was, however, something more than mere profit-sharing, and the association of the various sections of the works and offices with the management through the Co-partnership Council was a valuable feature which had become a part of the organisation. The report and accounts were adopted.

Calcutta Electric Supply Corporation, Ltd.

The annual meeting was held on May 11th, Lord Meston (chairman) presiding. In presenting the report and accounts (ELEC. REV., May 8th, p. 803), the chairman said that despite political excitement, boycotts, and severe trade depression, the business had more than held its own. There had been a gratifying increase in new customers, both industrial and domestic, but the depression in the jute industry had hit them badly. The system of distributing surplus profits between shareholders and consumers, which began two years ago, had not met with the success hoped for. They had accordingly determined, in place of a consumers' bonus this year, to reduce the domestic flat rate from 3 annas to 2¼ annas per kWh from June 1st next. This concession would be worth over £50,000 a year to consumers. Revision in the tariffs for other supplies had been made, or proposed, all of which would result in the extended use of electricity, especially as they were arranging for a new and active sales organisation in Calcutta. Regarding the scheme which the Calcutta Corporation had under discussion for a central power station of its own, the Corporation already generated its own electricity for the water supply and sewage, and the scheme in question aimed at taking over those other services which the company at present performed for it. In the board's view, the scheme was defective, and its cost had been gravely under-estimated. If, however, the scheme developed, the loss to the company would be something under 5 per cent. of the gross revenue. The chief engineering developments during the year included work on the tunnel under the river Hooghly, the installation of additional boiler plant at Cossipore, and the completion of the 20,000-kW turbo-alternator, with three 60,000-lb. boilers, at the Southern station. The report and accounts were adopted.

Shanghai Electric Construction Co., Ltd.

The report for the year ended December 31st last shows a profit of £142,964, to which is added £20,840 brought forward, making £163,804. From this is deducted provision for renewals (£40,000), taxation £25,000, reserve £7,696, and a contribution of £2,113 to the Shanghai staff provident fund. A final dividend of 7 per cent. is recommended, making 12 per cent. for the year, leaving £16,996 to be carried forward. The report states that 10 additional trolley-'buses were completed and put into service during the year. The royalty payable to the municipality on the gross receipts from the trolley-'bus services was reduced from January 1st, 1930, from 5 per cent. to 1¼ per cent., while a revision of fare stages with an increase in rates became effective on April 20th, 1930. Owing to a general strike towards the end of April, 1930, the company's services were completely shut down for 14 days. As managers of the Singapore Traction Co., Ltd., the company participated in the profits of that company for the year ended September 30th last, to the extent of £16,000. Meeting, May 21st.

South Wales Electrical Power Distribution Co.

The report for the year ended December 31st last shows net receipts of £148,717, as compared with £146,396 in 1929, and after deducting expenses, debenture interest, &c., there remains a balance of £23,210. The directors recommend that £20,000 be transferred to depreciation and reserve account and that £3,210 be carried forward. The report states that during the year £19,585 was spent upon plant, machinery, mains, sub-stations, &c. Approximately 31 miles of overhead and underground cables were brought into service, making a total length at the end of the year of over 380 miles. Supplies of electricity were made available in nine additional districts, and applications were made for Orders to supply the West Usk and Nantyglo and Blaina districts. Reference is made to the acquisition of a controlling interest in the company by the Shropshire, Worcestershire & Staffordshire Electric Power Co. In consequence of this a new board was appointed by the Shropshire Company. Mr. W. North Lewis remains as chairman of the company, and Mr. J. T. H. Legge has been appointed managing director.

Ever Ready Company (Great Britain), Ltd.

The report for the year ended March 31st last shows a net profit of £306,110, as compared with £244,555, to which is added £34,000 brought forward. After deducting £89,896 allocated to reserves, and £2,860 contributed to staff benevolent fund, there remains available for dividend £247,355. It is proposed to pay a final dividend of 25 per cent. on the ordinary shares, making 35 per cent. for the year, and to carry forward £37,375. The report states that the growth of the business again necessitated works extensions, £50,000 having been expended during the year on buildings and equipment, including £20,000 by the subsidiary companies, and since March 31st last further expenditure, amounting to £45,000, has been sanctioned. The death of Mr. L. P. Lightstone, a director, and the appointment of Mr. W. T. Walker to the board, are recorded.

Yorkshire (Woollen District) Electric Tramways

The total revenue for 1930 amounted to £357,677, as against £315,607 in 1929. Expenses, including provision for renewals, totalled £329,989, leaving a surplus of £27,688 (£19,924). Reserve receives £10,000, and the ordinary dividend is 8 per cent. (against 6 per cent.), leaving £14,706 to be carried forward. A Bill is being promoted in Parliament to enable the company to abandon the tramways, and to provide a service of motor omnibuses in substitution. Mr. Leo M. Myers has resigned the chairmanship of the company, but remains on the board, and Mr. P. M. Rossdale has been appointed director and chairman. Sir Thomas E. M. S. Pilkington and Mr. J. B. Walford have resigned their seats on the board.

British Power & Light Corporation (1929), Ltd.

The annual meeting was held on May 12th, Mr. H. A. Vernet (chairman) presiding. In presenting the report and accounts (ELEC. REV., May 8th, p. 802) the chairman said in view of the circumstances, the directors had again to ask the shareholders to forgo the payment of a dividend. The earnings of the subsidiaries were coming in less rapidly than was estimated at the start, and considerable capital expenditure had had to be provided for, and more would be needed in the future. The long-continued depression in industry had its effect upon the earnings of the subsidiaries, particularly those of the North Wales Power Co. The distribution of electricity to authorised undertakers showed good progress, those sales showing an increase for the year of some 20 per cent. The average increase in sales was 9¼ per cent., which compared with the average for the whole of the country of 5¼ per cent. While the English distribution companies had still a long way to go to attain the estimate of earnings and profits, there was every prospect of those companies becoming adequate contributors to the success of the Corporation. The report and accounts were adopted.

Barcelona Traction, Light & Power Co., Ltd.

The report for 1930 shows a total revenue of $4,596,951, as compared with $4,832,369 in the preceding year, the reduction being accounted for by depreciation in Spanish exchange. The net revenue was $2,714,966, to which is added $1,159,099 brought forward, making $3,874,085. The unification of the share capital was successfully carried through, and the capital issued and outstanding is now represented by 1,798,854 ordinary shares of no par value. Two dividends each of 50 cents per share were paid on the unified shares in 1930, and a balance of $938,787 is carried forward. Since the close of the year a further dividend of 50 cents per share has been paid on the unified shares. When the capital was unified it was increased by the creation of an additional 400,000 ordinary shares, the authorised capital is now, therefore, 2,500,000 ordinary shares of no par value.

Ebonite Container Co., Ltd.

Presiding at the annual meeting on April 28th, Mr. E. B. Ridsel (chairman), in the course of his speech, said that the profit for the 14 months amounted to £10,664, before charging directors' fees. The profit included £4,882 net dividend received from Ferguson, Shiers & Co. (Failsworth), Ltd. The profit at Belle Isle works amounted to £4,394, so that they earned a fair return on the capital invested in that section of their business. As compared with the preceding year, there had been a large falling-off of trade, and prices had also been very keen, but economies had been made by the managing and technical directors, who were satisfied that the business was holding its own. The profit of Ferguson, Shiers & Co. amounted to £17,386, and they had paid a dividend of 10 per cent. They had a very sound balance-sheet, and he could not understand why their shares were quoted on the market at such a low price.

Swedish Company

The report for 1930 of the *Telefon Aktiebolag L.M. Ericsson*, Stockholm, states that the manufacturing and sales activity considerably increased and the volume of orders on hand at the close of the year was higher. The net profits rose from 7.11 to 7.17 million kronen and the dividend is maintained at 8 per cent. In connection with the match monopoly loan made by the Kreuger and Toll Co. to Poland the report states that the Ericsson Company has been ensured certain preferential rights in deliveries to the Polish concession company and also guarantees of that company's continued undisturbed activity. Concerning the English branch, the report mentions that it was able to increase its net profit last year and has now begun the production of automatic totalisator installations.

Provincial Tramways Co., Ltd.

The report for 1930 states that the profits, as compared with the preceding year, disclose a reduction of £4,662. The credit balance on revenue account amounts to £10,817, plus £3,649 brought forward. After deducting debenture interest, &c., the directors propose to place £5,000 to reserve and to carry forward £4,257. The report puts forward proposals for dealing with the arrears of dividends on the preference shares.

The total revenue of the *Potteries Electric Traction Co., Ltd.*, for 1930 was £373,756, and after meeting expenses, &c., and adding £5,413 brought in, there is a balance of £68,972. Debenture and loan interest absorbs £19,576, and provision for renewals takes £41,430, leaving £7,965 to be carried forward. The arrears of dividend on the cumulative preference shares amounted, at the end of the year, to £84,219. The report records the death of Mr. E. Garcke.

The report of *Richard Johnson & Nephew, Ltd.*, for the year ended March 31st last shows a profit of £31,914, as compared with £40,673 in the preceding year, to which is added £16,370 brought in, making £48,284. The proposed ordinary dividend is 5 per cent. (against 8 per cent.), leaving £20,384 to be carried forward. The reduction in profit is attributed to the acute depression in the wire trade.

The directors of the *Chloride Electrical Storage Co., Ltd.*, have declared a final dividend of 10 per cent. actual, tax free, making 15 per cent. for the year. The capital was increased last year by the creation of 395,550 "A" ordinary and 112,907 "B" ordinary shares. The present dividend is therefore equivalent to that paid last year on half the existing capital.

Richardsons, Westgarth & Co., Ltd.—The report for 1930 shows a loss of £46,681. After transferring £49,217 from general reserve and £10,500 from preference dividend reserve, and deducting debenture interest and preference dividend to April 30th last, a credit balance of £161 is carried forward, against £445. Mr. G. Clark, managing director, has resigned, and it is not proposed at present to appoint a successor.

The *Weston-super-Mare and District Electric Supply Co., Ltd.*, reports a net revenue for 1930 of £42,954 (against £40,690 in 1929). Expenses absorbed £27,903, and general reserve receives £12,500 (£15,000). The ordinary dividend is maintained at 10 per cent., and £6,899 is carried forward.

The net revenue of the *Merthyr Electric Traction and Lighting Co., Ltd.*, for 1930 was £27,820 (as against £25,278 in 1929). After deducting expenses and placing £10,000 to general reserve, it is proposed to pay an ordinary dividend of 6 per cent. (against 2½ per cent.), leaving £6,258 to be carried forward.

The accounts of the *Bridgwater and District Electric Supply and Traction Co.* for 1930 show that after providing for depreciation, interest charges, &c., there is a balance of £1,659. The ordinary dividend is again 7 per cent. and £1,552 is carried forward.

The report of the *Lewes & District Electric Supply Co.* for 1930 shows a net revenue of £13,688 (against £12,487 in 1929). After deducting expenses, debenture interest, &c., and placing £4,500 to reserve, a dividend of 10 per cent. (against 8 per cent.) is paid, leaving £3,750 to be carried forward.

The directors of the *Lancashire Electric Light and Power Co., Ltd.*, have recommended a dividend of 6¼ per cent., less tax, on the ordinary shares for the year to March 31st last (against 7 per cent.).

Glenfield & Kennedy, Ltd.—A final dividend of 6 per cent. is recommended, making 10 per cent. for the year. In the previous year the dividend was the same, but with an additional bonus of 2½ per cent.

Siemens Bros. & Co., Ltd., have announced a final dividend of 5 per cent. on the ordinary shares, making 7½ per cent. for the year (same).

Melbourne Electric Supply Co., Ltd.—An interim dividend of 3¾ per cent. tax free, has been declared on the consolidated ordinary stock.

An interim dividend is announced by the *Pennsylvania Water and Power Co.* of 75 cents per common share for the quarter ending June 30th.

Stocks and Shares

TUESDAY EVENING.

THERE was some little talk in the City this week as to the possibility of a reduction in the Bank of England Rate being made on Thursday, owing to the Federal Reserve Bank of New York reducing its rediscount rate to 2 per cent. at the end of last week. The latter reduction was made, however, rather with the idea of assisting the financial and the trade position in the United States than as being a reflection of monetary conditions, although the latter are certainly easy enough to warrant New York in taking the step just mentioned. So far as the Bank of England is concerned, the situation is a little different, and the 3 per cent. rate, inaugurated on May 1st last year, will probably be left standing.

The easiness of money continues to be one of the features in Stock Exchange markets, and is responsible for further advances which have occurred in stocks of the purely gilt-edged groups. Apart from this, a flat tendency is noticeable in many sections. Some Stock Exchange people refer to the all-round decline as a "silent panic."

Gilt-Edged Stocks

The Central Electricity debenture, London & Home Counties debenture, and London Power debenture stocks have strengthened on investment absorption. The amount of stock available for investment in these particular issues is now very small, and no surprise would be felt if the two former issues were advanced to 100. The price of the London Power stock stands at 103¾, and investment is somewhat reluctant to pay much more premium than this represents. The three stocks have got into permanent hands, and it is difficult to obtain the offer of a substantial sum of any of them. Of trustee securities in the Underground Railways group there is on offer £10,000 Central London 4½ per cent. debenture at 95, and a small amount of City and South London 4 per cent. debenture at 83½. London Electric 4 per cent. debenture can be bought, as to £2,000, at 85. The yield on this trio is a shade over 4¾ per cent., making allowance for the amount of accrued interest. Of the T.F.A. stocks, £1,000 London Electric 4½ per cent. debenture, 1942-1972, is on offer at 100½, to give 4½ per cent., taking into account the accrued interest due on July 1st next.

Electric Railway Weakness

The uncertainty felt in regard to the manner in which the Metropolitan Railway will be treated under the London Passenger Transport Bill resulted in a fall of 8 points to 49½. The group of stocks is lower as a whole. Underground Electric ordinary eased off to 20s. 6d. Districts are 4 points down at 69½. Discussion continues to rage round the terms that are offered to the various undertakings affected by the scheme. Lord Ashfield has cast his vote in favour of the proposals

offered by the Government; but, in spite of this, the opinion in regard to the advisability of accepting the terms is by no means unanimous. It is reported in the Stock Exchange that the latter represent the full extent to which the Government is prepared to go.

The prices of the Tramway issues are irregular. London United Tramway 4 per cent. debenture has fallen 5 points to 62½. On the other hand, London & Suburban Traction preference are in demand, and there are buyers prepared to pay 12s. 6d. or more. The company's ordinary shares are quoted at 2s. 6d. London United Tramways 5 per cent. preference are changing hands fairly freely on the basis of 4s. British Electric Traction deferred at 1,150 is 100 points lower on the week, and the company's preferred ordinary stock at 127½ shows a drop of 4.

London Electricity Supply

Kensington ordinary shares are 6d. better at 29s. 6d. Metropolitans have eased off to 39s. 6d.; City of London ordinary fell 1/16 to 36s. 3d. County of London also are 1/16 down, at 43s. 9d. Amongst the provincial shares, Lancashire Electric Light & Power are 1s. easier, on a reduction in the dividend to 6½ per cent. as against 7 per cent. in the previous year. The South Wales Electric Power Distribution shows an available £23,200 from its net receipts for 1930, as against £29,600 in the previous year. The company is now controlled by the Shropshire, Worcestershire and Staffordshire Electric Power Company. The report states that the organisation of the two companies is being co-ordinated with a view to economies and improvements in service. The 6½ per cent. preference shares are quoted at 18s. 9d. Scottish Power ordinary are a little lower at 28s. Bournemouth and Poole have lost 1/16 at 58s. 9d., and Richmond (Surrey) fell 1s. to 41s. 6d. Amongst other electrical shares, Whitehall 7½ per cent. preference have eased off to 24s. 6d. Atlas ordinary are lower at 16s. 6d. The preference moved up a trifle to 24s. 6d. The City of Berlin has agreed to sell its municipal electricity works to a company that will be governed by a consortium of leading German and foreign banks. The proposal was passed by the narrow majority of 4 votes out of 204. Prussian Electric 6 per cent. bonds at 81½ are 2 down.

Brush Electrical

A feature in the prices of the shares in manufacturing and equipment companies is a fall of 27½ points in Brush Electrical Manufacturing ordinary stock, which has reduced the quotation to 67½. This follows upon a drop of 10 points last week. The company has cut its dividend in half, reducing it, that is to say, from 10 per cent. to 5 per cent. The meeting took place on Monday in this week, when the chairman dealt with the principal reasons that accounted for the drop in profits from £59,000 in 1929 to £6,600 last year. A Stock Exchange firm, working on the known figures, points out that the liquid position is strong. It estimates that the company has £805,000 in assets against the ordinary capital of £408,000, approximately, that is to say, £160 for each £100 stock. It is not, of course, the financial position of the company that has brought about the reduction in profits, for many concerns, inherently strong, have found their earning capacity severely curtailed by depression in trade the world over.

Manufacturing and Equipment

G.E.C. ordinary shares have fallen 4s. 3d. to 39s. 6d. British Aluminium are 2s. lower at 27s. Associated Electrical Industries ordinary are down to 19s. 3d. xd. On the other hand, there has been something of a recovery in British Insulated, Callenders and Enfields. Johnson & Phillips are flat at 27s. 6d. xd. Siemens receded to £1, in spite of the fact that the dividend is to be maintained at 7½ per cent.

Cables and Wireless

The only consolation to be derived by holders of Cables and Wireless stocks this week is that the falls are less in extent than others to which recent happenings have rendered the proprietors accustomed. The preference and the ordinary stocks are both down 2 points, the former going back to 53½, a price at which the yield on the money comes to over 10 per cent.—assuming, of course, that the dividend is duly met. Anglo-American deferred is a little lower at 25½. Marconi Marines weakened to 32s. 6d. International Automatic Telephones at 27s. 6d. are 3s. 9d. down, but, on the other hand, International Telephone and Telegraph shares at 29 have moved up a dollar, and American Telephone and Telegraph at 187½ shows no alteration.

Miscellaneous Matters

Babcock & Wilcox have gone back to 40s. Vickers are dull at 6s. 6d. The general tendency of the iron and steel market is heavy. No alterations worth mentioning have occurred amongst rubber shares, although the price of the raw material at 3½d. per lb. is better than it was a week ago. The group of American stocks and shares has moved irregularly. Shawinigan Water at 44 are a couple of points better. The company is paying a quarterly dividend of ¾ of a dollar per share, and the figures for the past four years show steady expansion. At their present prices, the shares pay nearly 6 per cent. on the money. Dollar stocks are lower as a whole. The flatness is so acute in most departments of the Stock Exchange, outside those devoted to purely gilt-edged stocks, as to provoke fears of financial difficulties on a large scale.

Share List of Electrical Companies

Home Electricity Companies

	Nom.	Approx. Dividend 1929.	1930.	Price May 12 1931.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	58/9	—1/16	5 2 0
Brompton Ordinary	1	8½	8½	28/-		5 0 0
Central Electricity 4½% Deb. ...	Stock	—	—	9/6	+1	4 13 9
Charing Cross Ordinary	1	8½	8½	29/6	—	4 15 0
Chelsea	1	8⅞	8⅞	27/6	—	5 1 10
City of London	1	10	10	36/3	—1/16	5 10 3
Clyde Valley	1	8	8	30/-	—⅛	5 6 8
County of London	1	7	10	43/9	—1/16	4 11 4
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	48/-	—	4 11 7
Kensington Ordinary	1	8	8	29/6	+6d.	4 15 0
Lancs. Light and Power	1	7	6½	23/-	—1/-	5 13 1
London & Home Counties 4½% Deb.	Stock	—	—	96	+½	4 13 9
London Electric	1	8½	9	34/-	—	5 5 11
Metropolitan	1	9	10	39/6	—1/8	5 1 3
Midland Counties	1	6½	7	27/6	—6d.	5 1 10
Mid. Elec. Power	1	15	8	28/9	—	5 11 4
Newcastle-on-Tyne Ordinary ...	1	6	6	22/6	—	5 6 8
do. 7% Pref.	1	7	7	27/-	—	5 3 8
Notting Hill 6% Pref.	10	6	6	11½	—	5 6 8
North Met. Elec. 6% Pref.... ...	1	6	6	24/-	—	5 0 0
St. James' and Pall Mall	1	8	8	28/6	—	4 18 3
Scottish Power	1	8	8	28/-	—6d.	5 14 4
South London	1	8½	8½	28/-	—	5 0 0
Urban Ordinary	1	7	7	28/9	—	4 17 3
Westminster Ordinary	1	8½	8½	28/6	—	4 18 3
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	24/6	—6d.	6 2 5
Yorkshire Elec.	1	8	8	32/6	—	4 18 6

Home Rails

Central London Ord. Assented ...	Stock	4	4	77	—	5 4 0
Metropolitan	,,	4	3½	49½	—8	7 1 5
do. District	,,	5	5	69½	—4	7 4 0
Underground Electric	£1	8	8	20/6	—2/-	7 16 1

Telegraphs and Telephones

Anglo-Am. Tel. Pref....	Stock	6	6	106	—	5 16 5
do. Def-	,,	1½	1½	25½	—½	5 17 8
Automatic Telephone	1	12½	12½	35/-	—	6 13 4
Cables & Wireless 5½% Pref. ...	Stock	5½	5½	53½	—2	10 5 8
do. A 7½% Ord.	,,	Nil	—	15	—2	... ...
do. B Ord.	,,	Nil	—	10	—	... ...
Globe Tel. and T. Ord.	10	10	—	10	—	... ...
do. do. Pref.	10	6	6	10	—½	6 0 0
Great Northern Tel.	10	20	20	29½	—½	6 16 9
Marconi-Marine	1	15	15	32/6	—1/3	9 4 8
Oriental Telephone Ord.	1	12	12	9⅝	—	*5 1 0

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	4½	—	1⅛	—	... ...
do. do. 2nd Pref. ...	5	6	—	12/6	—	... ...
do. do. 5% Deb. ...	Stock	5	5	80½	—	16 8 0
British Electric Traction Def. Ord.	,,	5	5	1150	—100	... ...
do. do. Pref. Ord. ...	,,	8	—	127½	—4	6 5 6
Brazil Traction	100	8	—	16⅞	—1½	... ...
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	97½	—	5 2 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	62½	—5	6 8
Mexico Trams, 5% Bonds	—	5	5	50½	—	9 18 0
Mexican Light Common	100	Nil	Nil	42½	—	... ...
do. 7% Pref.	100	7	7	70½	—	9 18 6
do. 1st Bonds	—	5	5	80	—	6 5 0
Victoria Falls Ord.	1	15	15	58/-	—	5 3 5
Yorkshire (West Riding)		Nil	Nil	5/6	—	... ...

Manufacturing Companies

		1928.	1929.			
Assoc. Elec. Ord.	1	6	6	19/3xd	—1/-	6 4 8
do. Pref.	1	8	8	27/6	—	5 16 0
Babcock & Wilcox	1	13	15	42/-	—3/6	*7 0 0
British Aluminium Ord.	1	10	10	27/-	—2/-	7 8 3
British Insulated Ord.	1	15	15	2⅝	+⅛	5 14 3
Brush Ord.	Stock	10	10	67½	—27½	7 8 2
Callenders	1	15	15	2⅞	+⅛	5 17 0
do. 6½% Pref....	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	—	20	1/1½	—	7 1 2
do. 8% Pref.	1	8	8	28/-	—	5 14 5
Edison-Swan 1st Pref.	1	7½	7½	23/9	—	6 6 4
do. 5% Deb.	Stock	5	5	94½	—	5 5 10
Electric Construction	1	6½	5	12/6	—	8 0 0
Enfield Cable Ord.	1	20	25	3½	—	6 8 10
English Electric	1	Nil	Nil	5/-	—1/2	... ...
do. do. Pref.	1	8	Nil	5/9	—6d.	... ...
Ferranti Pref.	1	7	7	21/6	—	6 10 4
G.E.C. Pref.	1	6½	6½	26/-	+6d.	5 0 0
do. Ord.	1	10	14	39/6	—4/3	7 1 9
Henley	1	25	30	4½	—	6 3 0
do. 4½% Pref.	5	4½	4½	4½	—	5 2 10
India-Rubber	1	Nil	Nil	5/-	—	... ...
Johnson & Phillips	1	10	10	27/6	—5/-	7 5 6
Siemens Ord.	1	7½	7½	1	—⅛	7 10 0
Telegraph Construction	12	10	10	13½	—	9 5 3

*Dividends paid free of Income Tax.

Indian Electrical Import Trade

Figures for 1928-29 and 1929-30 Compared

THE following are the figures of the electrical imports into India during the twelve months ended March 31st, 1930. In accordance with our usual practice the comparative figures for 1928-29 are given and the increases or decreases are also shown :—

	1928-29. Thous. Rs.	1929-30. Thous. Rs.	Inc. or dec. Thous. Rs.
Electrical machinery—			
Control and switchgear (total)	3,040	3,830	+ 790
From United Kingdom ...	2,600	3,250	+ 650
,, Germany	140	260	+ 120
,, United States ...	470	320	− 150
Generators, alternators and dynamos (total)	4,300	4,400	+ 100
From United Kingdom ...	3,750	3,880	+ 130
,, Germany	300	230	− 70
,, Switzerland	3	110	+ 107
Motors (total)	4,500	4,400	− 100
From United Kingdom ...	3,120	3,510	+ 390
,, Germany	290	250	− 40
,, Belgium	30	120	+ 90
,, United States ...	810	350	− 460
Transformers (total)	1,090	1,860	+ 770
From United Kingdom ...	730	1,190	+ 460
,, Sweden	22	100	+ 78
,, Germany	50	120	+ 70
,, Italy	5	30	+ 25
Turbo-generating sets (total)...	600	800	+ 200
From United Kingdom ...	170	540	+ 370
,, Germany	30	7	− 23
,, Switzerland	90	105	+ 15
,, Italy	—	110	+ 110
,, United States ...	110	40	− 70
Other electrical machinery (total)	10,150	8,790	−1,360
From United Kingdom ...	8,170	5,950	−2,220
,, Canada	—	190	+ 190
,, Germany	510	750	+ 240
,, Belgium	140	280	+ 140
,, France	13	100	+ 87
,, Italy	24	230	+ 206
,, Japan	94	140	+ 46
,, United States ...	1,060	960	− 100
Electric fans and parts thereof—			
Total	3,844	3,980	+ 136
From United Kingdom ...	2,367	1,890	− 477
,, Italy	1,034	1,210	+ 176
,, United States ...	104	370	+ 266
,, Germany	315	475	+ 160
Electric wires and cables, rubber insulated—			
Total	3,996	4,230	+ 234
From United Kingdom ...	3,558	3,470	− 88
,, Germany	212	330	+ 118
,, Netherlands	108	100	− 8
,, United States ...	52	85	+ 33
Insulations other than rubber—			
Total	3,037	4,320	+1,283
From United Kingdom ...	2,607	4,040	+1,433
Telegraph and telephone wires and cables—			
Total	176	85	− 91
From United Kingdom ...	166	70	− 96
Bare copper wire (electrolytic)—			
Total	2,725	2,890	+ 165
From United Kingdom ...	2,381	2,160	− 221
,, Netherlands	95	220	+ 125
,, Japan	50	290	+ 240
All electric wires and cables—			
Total	9,934	11,530	+1,596
From United Kingdom ...	8,713	9,740	+1,027
,, Germany	437	580	+ 143
,, Netherlands	250	350	+ 100
,, Japan	61	310	+ 250
,, United States ...	346	240	− 106
Telegraph and telephone instruments and apparatus—			
Total	525	540	+ 15
From United Kingdom ...	464	480	+ 16
Batteries—			
Total	1,306	1,370	+ 64
From United Kingdom ...	189	180	− 9
,, United States ...	749	770	+ 21
Carbons, electric (including furnace electrodes)—			
Total, largely from U.K. ...	134	290	+ 156
Accumulators (including parts)—			
Total	1,991	2,590	+ 599
From United Kingdom ...	1,583	1,830	+ 247
,, United States ...	343	335	− 8
Electric lighting accessories and fittings (including switches)—			
Total	1,693	1,690	− 3
From United Kingdom ...	1,266	1,030	− 236
,, Germany	278	320	+ 42
,, United States ...	68	160	+ 92
Electrical instruments (other than telegraphic and telephonic meters)—			
Total	728	930	+ 202
From United Kingdom ...	592	690	+ 98
,, Germany	85	120	+ 35
Electrical instruments (other sorts)—			
Total	415	250	− 165
From United Kingdom ...	310	120	− 190
,, Germany	60	100	+ 40
Electromedical apparatus—			
Total	371	430	+ 59
From United Kingdom ...	116	110	− 6
,, United States ...	150	215	+ 65
Switchboards—			
Total	480	290	− 190
From United Kingdom ...	422	250	− 172
Unenumerated electrical goods—			
Total	4,950	5,700	+ 750
From United Kingdom ...	2,891	3,820	+ 929
,, Germany	671	735	+ 64
,, Japan	150	90	− 60
,, United States ...	1,112	870	− 242
All electrical instruments and apparatus—			
Total	31,295	36,095	+4,800
From United Kingdom ...	19,899	21,515	+1,616
,, Germany	3,038	4,270	+1,232
,, Netherlands	1,486	1,620	+ 134
,, Italy	1,210	1,395	+ 185
,, Japan	561	960	+ 399
,, United States ...	3,950	4,750	+ 800

Imports of lamps in 1929-30 totalled Rs. 4,060,000 in value, including Rs. 1,170,000 flashlights, Rs. 140,000 automobile lamps, and Rs. 2,600,000 standard lamps. The total value in 1928-29 was Rs. 4,190,000.

The Colombian Electrical Market

THE Canadian Trade Commissioner at Bogotà, in reviewing conditions in Colombia, makes certain statements which, while not indicating immediate increase in import trade, possess interest in view of the revival which it is hoped will not be long delayed. In so new an industry as electrical appliances, progress is less dependent upon general revival than it is in some other trades. All the cities in the country have energy available for lighting and power and in every case it is generated in the area in which it is consumed; there are no long transmission lines. Even when there is general depression the natural movement is to turn to electricity if it can be done without too great expense.

The power plants in Barranquilla, Cali, and Honda are controlled by American interests, while the remaining plants are either privately or municipally owned. The rates charged for power for domestic consumption are stated to be invariably very high and to preclude its general use for cooking and heating. Further, although the majority of the houses are wired for lighting, the wires and accessories installed are of very cheap types. It is stated that materials are not tested, and that there are no set standards; all of which suggests that there is room for somebody to do some good work. In street lighting very little modern equipment is installed.

There is a limited market for electric heaters, but so far sales are chiefly to foreign residents; yet the cool climate, particularly in Bogotà and Medellin, warrants the use of some form of heating in the homes. Progress in this line will be slow, as the Colombians do not feel that artificial heating is healthy! Sales of other domestic electrical apparatus such as toasters and irons, washers, &c., are very limited, and are confined almost entirely to foreigners and a few of the wealthier Colombians.

The rates for electrical power for domestic use in Bogota are 16 cents per kWh for the first 50 kWh consumed, with reductions for additional power consumption. Rates elsewhere in Colombia are comparable. Almost universally throughout the country the system of electricity supply is 110 V, 50-cycle, 2-wire.

Trade with the Far East

Great Britain's Position in Chinese and Japanese Electrical Business

THE possibilities of increasing the British share of the electrical trade of China and Japan are studied in the report of the British Economic Mission to the Far East*, of which Sir Ernest Thompson is chairman and Lt.-Col. R. K. Morcom, C.B.E., a member.

With a population of between 400 and 500 millions China has a foreign trade of approximately 12s. *per capita*, the smallest in the world. At present the country is industrialised to an insignificant extent and the reconstruction and modernisation of the country will absorb increasingly large quantities of machinery. The Chinese Government is fully alive to this fact and is giving close attention to the problems of speeding up development. In contracts for large plant, credit is a more important factor than price, and risks will have to be taken if orders are to be obtained. In small plant and apparatus for small buyers a low price is more important and this is only possible by means of mass production after close study of the requirements of the market. Competition in China is undoubtedly keen, but in machinery and constructional work the market is by no means a bottom-price one; the Chinese will frequently pay for a good article if they are convinced of its superiority.

Electricity Supply in China

The scope for British electrical manufacturers is indicated in a section of the report dealing with the subject of electricity supply in China. In this it is stated that "the use of electric light is very popular, and to-day every town of any importance has electric light, but often in very small units." It is suggested that each town is a nucleus for development either by linking into a comprehensive scheme or by normal extension. There is a demand for electrical plant from the growing Manchurian towns, but extended credit is expected. Altogether there are over 400 large and small supply stations, the largest of which is the 140,000-kW plant at Shanghai. The British share in the supply of power plant has been considerable. British industry has equipped the greater part of the Shanghai undertaking, and has supplied large plant for such installations as the Mukden Arsenal, Tientsin, Kowloon, Hankow, Hangchow, and for a large number of isolated installations with Diesel or steam engines. The estimated annual increase in plant capacity since 1923 has been between 50,000 and 60,000 kW; of this, it is said, the British contribution has averaged about 40,000 kW a year.

Outside Shanghai, stations of over 20,000-kW capacity exist at Dairen, Fushun Colliery, Hongkong, Kowloon, Canton and Hankow. In addition there are about half a dozen stations of from five to ten thousand kW, and as many more of one to five thousand. Excepting the large foreign-run stations in treaty ports, the development of existing stations is fraught with many difficulties. Lack of capital, depreciated plant, leaky mains and thefts of current are among these. At Canton, for instance, of actual units generated only 30 per cent. are paid for, and it remains to be seen whether stringent regulations which have been introduced to stop illicit use will be effective. A Government Department has been formed to investigate the expansion of existing plants and also to standardise the rules governing them.

A Large-scale Electrical Scheme

There is a proposal to form a company with capital provided by the Government, the banks and foreign concerns to carry out an ambitious electrical construction programme in the Lower Yangtse area. The foreign contribution would take the form of cash or plant, while the Government (represented By the National Construction Commission), following its previous practice, would issue short-term bonds. It is proposed to institute a 66,000-V, 3-phase, 50-cycle network fed by 60,000 kW of existing plant. This plant would be extended by 40,000 kW, and three new 40,000-kW stations would be erected at Nanking, Kiangyin, and Chinkiang. This would complete the first half of the 400,000-kW programme which the Commission has in view. The latter half involves the erection of 60,000-kW stations at Nanking, Kiangyin and Hangchow, with seven secondary stations ranging in capacity from 3,000 to 40,000 kW. Orders in connection with the first part of the scheme have already been placed. A contract for a 15,000-kW extension for Hangchow has been given to a British concern and three small orders to the A.E.G. and Siemens-Schuckertwerke. At an early date orders are to be placed for a further 100,000 kW of plant, as well as sub-station equipment.

In general, finance schemes will be required for the extension of China's power supply. These schemes may take the form of municipal bond payments or of arrangements to pay out of revenue, and only in a limited number of cases will companies be floated to do their own finance in the usual way. Possibly co-operation with foreigners will be possible in some of the large schemes through some form of construction and operating corporation. The recent order for two 5,000-kW turbo-generators for Nanking has been accepted on terms arranged by the National Construction Commission—20 per cent. will be paid in cash and 80 per cent. in eight per cent. seven-year bonds issued by the Commission and backed by the States Council of China

* Stationery Office, 2s. 6d. net.

Chinese Telephones and Telegraphs

Some particulars are given of American activities in the Chinese system of communications. The International Telephone and Telegraph Corporation has been especially active in this connection through its manufacturing subsidiary, the China Electrical Co., which had record sales in 1929. An example of its activities is to be found in the construction of a rotary automatic exchange in Canton which was opened in August, 1929. In 1928, American radio engineers, acting as consultants without pay to the Government Radio Administration, prepared plans and specifications for a complete international radio service to and from China under joint American and Chinese control. In this way United States interests have secured control over wireless transmission and this must play a considerable part in the development of trade between the United States and China in the near future. Good orders have been secured by British contractors in the past, but they are now losing them owing to strong competition. In many parts of China, and in particular Manchuria, the local Chambers of Commerce are strongly in favour of telephone installations. Similar terms of credit may be asked for to those granted at Canton and probably the risk will not be serious.

Industrial Development in Japan

Japanese conditions are very different from those in China. Japan, like Great Britain, imports many of her principal raw materials, but as a result of a definite policy, is becoming increasingly successful in supplying her domestic needs of manufactured goods. Energetic assistance is being given to the engineering industry by the Japanese Government in many ways. Although in the immediate future work for Government services or public utilities will no doubt be carried out by Japanese firms, there are prospects that the increasing development of the country and the demand for improved public utilities will render it necessary for the country to import foreign machinery to a greater extent than at present.

A rather alarming feature of the report is the serious decline of imports from Great Britain during the last few years. In spite of an increase in volume of 23 per cent. in the total imports of China, the volume of imports from Great Britain has fallen by one-third. In Japan, too, although Great Britain supplied nearly one half in 1913, our share in 1929 had declined to less than a quarter. In contrast, Germany has since the war recovered her pre-war share, which in 1929 exceeded that of Great Britain, while the United States is by far the largest supplier of manufactured goods.

Some Adverse Factors

Among the reasons given for the decline of British trade with Japan is the "intelligent aggressiveness" on the one hand of the United States, mainly in providing the market with so large a number of modern mechanical appliances at moderate prices, and on the other of Germany's thorough and persistent cultivation of the market with goods at low prices. Moreover, throughout the period of the country's industrialisation the Japanese Government has encouraged its own industries by means of the tariffs and State regulations. Great Britain is further handicapped in the sale of her goods by her distance from the Japanese market and by a disparity in price arising from higher production costs.

The Commission's Recommendations

In Japan, it is stated, the representation of British manufacturers is not satisfactory; the British manufacturer should provide the stimulus for the sale of goods in that country. It is recommended that British manufacturers should strengthen their sales organistion (*a*) by attaching at their own expense technical and sales promotion experts to efficient merchant houses in Japan; (*b*) by undertaking sale and distribution themselves through their own branch establishments; and (*c*) by employing resident agents working on commission.

The report recommends that a conference of financial and industrial interests should be summoned by the British Government to explore the possibilities of participation in the development of the country. Other proposals include the education of young Chinese in Great Britain to use and appreciate our products, and the sending of more experts to instruct the Chinese in the use of our machinery.

Propaganda on the part of other nations is very intense in the Far East, and British publicity is far behind the times and ineffective in comparison.

The Department of Overseas Trade is urged to call a conference of bankers, industrialists, exporters and merchant houses for the purpose of inquiring into the complaints made of the failure of British finance to meet the needs of the Japanese market, and to consider the question of the provision of long-term credits for exports of machinery and equipment to China. The grouping of manufacturers for export purposes is also suggested.

In conclusion it is stated that the present decline in British trade in the Far East is due primarily to the high prices of British goods in comparison with those of our competitors and that until these are reduced to a competitive level there can be no hope for the renewal of trade prosperity.

Parliamentary Notes

[By our Special Parliamentary Reporter]

Beam Radio-telegraphy Stations

On May 4th MR. DAY asked the Postmaster-General whether any definite decision and action had been taken by the Government as a result of the Committee of the Cabinet which was appointed to report on the employment of beam stations for overseas telephony.

MR. ATTLEE said that, as announced by his precessor on February 26th, 1930, the Government decided, on the recommendation of a Cabinet Committee, to adopt the policy of conducting overseas wireless telephone services from this country by concentration at the Post Office stations at Rugby and Baldock. This policy had been pursued; and, in addition to the service with North America which was already in operation, direct radio-telephone services had been established to Australia, to Argentina (with connections to Chile and Uruguay), and to some of the large ocean liners. Telephone services with Brazil and New Zealand, and a direct service to Canada would shortly be opened and negotiations were in progress with the operating authorities in certain other countries.

Automatic Telephones

On May 4th MR. C. WILLIAMS asked the Postmaster-General if he would state the total cost of installing the automatic system in telephone exchanges in the London area now operating under this system.

MR. ATTLEE said that the total expenditure up to March 31st, 1930, the latest convenient date, was about £6,680,000. This figure included exchange equipment and accommodation costs but did not include external plant costs.

SIR W. DAVISON asked whether the new automatic exchanges had proved to be satisfactory in their working; whether it was proposed to convert further exchanges to the automatic system; and whether there was any question of abandoning or altering the automatic system where it had been already installed.

MR. ATTLEE said that the new automatic exchanges had proved satisfactory, and an extensive programme of further conversions was in hand. The question of abandoning or altering the automatic system at an exchange would arise only in exceptional circumstances; for example, in the case of an experimental installation.

Railway Electrification

On May 6th REAR-ADMIRAL BEAMISH asked the Minister of Transport whether, in the proposed railway electrification, precautions were to be taken against injury to stock and human beings at existing railway farm-crossings and others where protecting gates were not installed.

MR. MORRISON said that in carrying out any future electrification all necessary precautions against risk of injury at level crossings would be taken.

Aircraft and Electric Cables

On May 6th CAPTAIN BALFOUR asked the Under Secretary of State for Air if he could make any statement as to the result of the negotiations between the Air Ministry and the Electricity Commissioners regarding the guarding of aircraft from danger of contact with overhead high-pressure cables by means of the lighting of pylons or some other means.

MR. MONTAGUE said that meetings had taken place between representatives of the two Departments, and the technical aspects of the subject were under active consideration. A programme of experiments was being drawn up.

Traffic Control Signals

On May 6th MR. EVERARD asked the Minister of Transport if he would state the total number of installations of automatic traffic-control signals which had been approved for grants by his department; how many of these were of foreign and British manufacture, respectively; and what was the average length of time taken by his department before approval was given.

MR. MORRISON said that the total number of installations approved for grants up to April 30th was 333. Of these 87 were of British manufacture, 226 were manufactured by American firms who claimed that their equipment was mainly of British manufacture, and in 20 cases the selection of the equipment had not yet been decided. When the question of installing these signals first began to be considered, British firms had had little experience in their design and manufacture, but he was glad to say that the position had altered in this respect and preference was now given to home manufactures where possible. Taking the applications which had been received since the beginning of August last, the average length of time which had elapsed from the date of application to the date of the issue of grant had been eleven weeks.

Replying to a further question, he said he hoped that traffic-control signals would be in operation in Oxford Street by the end of June. The signalling apparatus (as distinct from poles, cables, &c.) was to be of foreign manufacture because, when the question of controlling traffic in this way in Oxford Street was first investigated, no British firms were manufacturing or had any experience of the type of signals required.

Legal

A Yacht Electrical Installation

AT the Southampton County Court on May 5th Messrs. J. W. Scott & Co., Ltd., electrical engineers, Southampton, sued Major S. C. Winfield-Smith for £100, the balance of an amount due for electrical work carried out in the defendant's yacht.

Mr. J. W. Scott, managing director of the plaintiff company, said that the work had been done according to specification and although the job, with the exception of some extra work, was completed at about the end of March last year there was no complaint until September. With regard to the entry of water into a switch and bulkhead lamp, witness said that that could not have happened if the covers had not been loosened.

Mr. W. J. Steele, chairman of the plaintiff company, stated that although he had seen the defendant several times between the completion of the work and September he had received no complaints. Other corroborative evidence was given.

The defendant said that on the trial voyage certain lights failed and serious defects were found in the lighting. He called witnesses to support his evidence.

The judge said that while he was impressed by the fact that no complaints had been made by the defendant in the course of correspondence, he could not resist the conclusion that all the fittings were not what they ought to have been. He gave judgment for the plaintiffs for £70 (including £50 paid into Court) and costs.

The British Blue Spot Co., Ltd.

AN action by the British Blue Spot Co., Ltd., against F. G. Keene, described as of Bond Street, St. James', Bristol, came before Mr. Justice Eve in the Chancery Division on May 5th on a motion for judgment in default of defence.

The claim was for an injunction restraining the breach or terms of a limited licence by selling a "Blue Spot" loud-speaker unit, type 66 K, under the fixed price of 25s.

The evidence was that the article was sold for 17s. 6d.

MR. SHELLEY, for the plaintiffs, asked for the injunction to operate during the life of the patent.

His Lordship granted the injunction with costs.

Emission Bands in the Mercury Spectrum

Lord Rayleigh, in a communication to *Nature**, refers to the long series of diffuse bands (from λ2943 to λ2614) which he found some years ago in the absorption spectrum of a long column of mercury vapour, and mentions that the same series was found independently and about the same time by Mohler and Moore. Up to the present, these bands have never been obtained in emission. He now finds that when mercury vapour is fluorescing under the iron arc (excitation from λ2650 to λ2537) these bands are emitted, and in much greater intensity if the vapour is superheated. The continuous emission from about λ2950 to λ3600 (maximum at λ3300) is also much increased by super-heating, while the green visual fluorescence is extinguished. So far as his experiments go, the emission bands seem to be in close relation to this continuous emission at λ3300, though he is not prepared at present to say that this is invariably the case. Much longer exposures are required for the bands than for λ3300, but when such exposures are given, the bands appear as a kind of prolongation of the continuous emission. The continuous region, it is to be noted, is at the less refrangible end of the band series, where the band spacing is widest, and not beyond the convergence point, and this continuous region, unlike the bands, is not known in absorption. It will be important to examine the absorption of the superheated vapour. The remarkable phenomena connected with the band spectra of mercury, and the long time of duration of the emission, are very complicated, and he thinks that speculation has rather outrun our knowledge of the facts, which is by no means adequate. It is his aim to find out as much as possible under conditions of low frequency excitation, less than the frequency of the atomic resonance line λ2537. These conditions should reduce the problem to its simplest form.

Road Transport and the Railways

In view of the fears expressed that traffic on the railways may decrease, due to the competition of road transport, to such an extent as to make electrification uneconomic, it is interesting to note that experience in France is to the contrary. According to *Modern Transport*, in France the number of passengers travelling by train in 1930 was nearly 250,000,000, or 45 per cent. more than in 1913; in Germany the railways carried over 2,000 million passengers in 1929, compared with 1,500 millions in 1913, an increase of roughly 30 per cent.; in the United States, although traffic has diminished, the railways, according to the latest statistics of the Interstate Commerce Commission, have earned nearly 200,000,000 dollars by carrying motor cars, which has more than compensated for the losses suffered since 1922 in passenger traffic. The Paris-Orleans Railway carried 36,579 passengers on its motor-coach services in 1930, as against 27,938 in 1929, whilst its passengers by rail increased from 83 to 84¼ millions.

* May 2nd, 1931.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Motor Impregnation

Some readers of the ELECTRICAL REVIEW may have been puzzled on reading the correspondence appearing under the above heading to account for the conflicting views expressed by different writers as to the merits, or otherwise, of the two principal methods of treating electrical windings with varnish, *i.e.*, dipping, or vacuum-pressure impregnation, and may have wondered why the recorded results of my own personal experience should be exactly the opposite to the results obtained by Mr. Wilcock. Too much value should not be attached to the exceptional results obtained occasionally on individual motors installed in a laundry, or even down a well in India. One should rather be guided by experience gained with hundreds of motors working under all sorts of conditions of which accurate records of the working have been kept and tabulated.

I think that the explanation of the difference in the results obtained by Mr. Wilcock and myself, and, therefore, in our recommendations, is simply due to the fact that Mr. Wilcock has not had the advantage of using the same type of vacuum impregnating plant, or the same process, as I have used. The majority of impregnating equipments in use at the present day do not differentiate between the two distinct phases "*evaporation of the solvents*" and "*oxidisation*," and they are generally done in one single operation without any system of control. Evaporation and oxidisation, however, are accompanied by quite different physical and chemical phenomena, which are mutually antagonistic. Premature oxidisation stops evaporation. Too rapid evaporation in the early stages causes porosity, and it is a common fault to apply vacuum during this stage. With the majority of methods in use, therefore, the impregnating medium is never hardened in the interior of its mass, and there is always solvent remaining in the windings. Improper methods of treatment are as frequent causes of "*greening*" as the imperfect drying out of coils before treatment, although in the majority of cases the quality of the varnish is blamed. This has been proved over and over again; greening taking place with certain makes of varnish when used with the dipping process, or with the usual type of vacuum impregnator, whereas the same varnish used in a correctly designed impregnating plant gave no trouble. The impregnating plant with which I obtained such good results at the iron and steel works, mentioned in my letter of March 27th, was fitted with a special solvent evaporating and oxidising device which certainly constitutes the greatest advance made in recent years in the science of impregnation. This device has been patented by the Soc. Anon. M.A.X.E.I. in most countries, including Germany and the U.S.A.

London, S.W.1, *May 5th*, 1931. A. C. DUNLAP.

"Use Bakelite"

Apropos the correspondence upon Bakelite mouldings, I have on my hands a number of small armatures fitted with moulded "Bakelite"(?) commutators. These commutators are moulded up solid with the use of clamp rings, and a brass bush is fitted for attachment to the armature shaft. The insulation between the segments is mica. No mica is used for "V" rings. The commutators which number about 30 have each developed faults at the "back end"; in each instance the fault has been located at the position normally occupied by the mica "V" ring, and is in the nature of a short-circuit between segments, but the position varies with the different commutators. In no instance does the fault indicate that the trouble has started from the top of the riser and worked down. On machining out the back insulation, the fault was cleared, and on testing between segments at a pressure of 300 volts a.c. everything seemed to be in order. Although the moulded substance has the characteristic smell of carbolic acid under heat, it appears from careful observation that the bulk of the compound is of a fibrous nature, probably asbestos bound with "Bakelite" varnish. The armatures are of continental manufacture. For the benefit of others and myself, I would value an opinion upon "Bakelite" as a suitable medium for commutator construction.

Enfield, *May 11th*, 1931. G. W. COOPER.

In your issue of May 8th on page 778 under the title "Wanted—A Name" appears a paragraph relating to "Bakelite." I am enclosing a copy of our January issue in which you will find that we deal with this matter. The result of the competition will be published in our May issue, which is published on the 15th inst. It is perhaps unfortunate that the present name of "Bakelite" has become the generic term of the trade for phenol resin powders.

THE EDITOR,
"British Plastics and Moulded Products Trader."

London, E.C.4, *May 8th*, 1931.

[The competition referred to offers a prize of ten guineas for a name acceptable to the moulded products trade as a suitable one for describing plastic materials generally.—EDS. ELEC. REV.].

Adaptable Electrical Motors

Mr. E. Graham Ross's original article was meant to be helpful, and I do not want him to think my criticisms were merely destructive. They were inspired by the knowledge that in encouraging "mechanical" buyers to ask for something they no longer can have he is running counter to the whole trend of development for which the buyers' policy is itself responsible. In short, he is, no doubt with the best of intentions, merely making trouble all round.

Motor manufacturers *do* look beyond their noses. Those who didn't are no longer manufacturers. Whilst shaping their policy to suit a demand that can be satisfied only by the lines on which they are proceeding to-day, they have simultaneously provided mechanical makers with a degree of flexibility which is far beyond anything that Mr. Ross has suggested.

It is possible to purchase from up-to-date firms merely the electrical viscera of a motor—the parts that require specialised knowledge to make—leaving the mechanical man the completest freedom in embodying those parts in his machine. I did not mention this before, as it is rather a side issue. Perhaps Mr. Ross was not aware of it, but the woodworking machine-tool people, for example, are fully aware of it, and utilise their knowledge.

This applies to motors of medium sizes. On "heavy" plant the demand for special features is more easily catered for, and is almost negligible anyway.

May 9th, 1931. STANDARDISATION.

Careers for Young Engineers

With reference to your numerous correspondents' letters on this subject, I once heard a professor of engineering at an English university say that during the three years course at the university they did not profess to teach a student any particular subject; but they *did* profess during that time so to train his mind to think that upon satisfactory conclusion of his studies he could go out into the world and take up any branch of engineering quickly to become a master of his subject.

This training, with vacations spent abroad, followed by an intensive "shops" course—for preference in a trade union shop—is ideal for those who are fortunate enough to be able to afford it. They should make no mistake, however, that the second portion of this training is harder than the first. It is followed by an "examination" (taking charge in a junior capacity of older men) which "ploughs" far more entrants than 'varsity finals.

What some of your correspondents fail to appreciate, however, is that to-day there are many youngsters who cannot afford three years' expenditure on a university career, followed by two years on apprentice pay. They must, at the age of 20, help to defray the family's expenses, let alone save in their own ultimate interests.

At the conclusion of their clocked day there exists only one alternative, evening classes, unless some provision for education is made by their employers.

Could not the unemployment benefit be given to men under thirty only on the condition that they attended regularly many of the already State-aided educational establishments? Surely any preliminary financing of such a scheme would be a good investment, if not for the State, then perhaps for some of the correspondence schools.

Bombay, *April 30th*, 1931. H. H. C. BARTON.

Leakage Trips for 100-A Circuits

With reference to recent correspondence on earth leakage trips, Mr. Grierson and Messrs. Drake & Gorham are talking about different trips designed for different purposes.

In the writer's opinion, a trip acting at 100 amperes or so is useless, as the fuses will blow long before this leakage current is reached.

It is no use blacking out a whole installation when the leakage is only in milli-amperes. Insert a circuit breaker on every sub-circuit, with an earth tripping device to notify defective sub-circuits, and then the scheme is valuable.

The writer has installed various circuit breakers to comply with I.E.E. Regulations, paragraph 94, but has never yet heard of the earth trip functioning. A circuit breaker designed to trip at 20 volts—15 milli-amperes—is only meant to actuate on a sub-circuit and not on mains, it is thought.

A little book called "Rural Electrification" contains useful information on the subject.

With regard to "Regulations of the Electrical Equipment of Buildings," Ninth Edition, May, 1927, issued by the I.E.E., paragraph 127, section "C," what does it mean? If the I.E.E. is uncertain of the requirements as to earthing, what can one expect a humble contractor to do, and further, if an ordinary 3-phase lighting system were wired delta instead of star, why worry about earthing at all?

London, W.C.2, *May 5th*, 1931. H. J. HOLMES.

Continuity

A surprisingly large number of installations is to be found in which iron-clad gear is used, in which the conduit system is not complete and the cables are unprotected between the various units.

A typical instance is illustrated in this week's issue of the ELECTRICAL REVIEW, page 781; this may be only a "temporary job," but there are numerous cases in which similar conditions exist permanently.

The conduit, if taken into the switches, &c., would not only protect the cables, but would also keep the interiors clean. The conduit would also be a solid means of earthing, as the individual units are invariably earthed by means of short lengths of thin earth wire and numerous earth clips. The cost of "fiddling about" with short pieces of earth wire and clips is as costly as making a solid conduit job, to say nothing of appearance and efficiency.

May 11th, 1931. G.P.

Works Outings: A Protest

About this time of year we are inundated with requests from customers to contribute towards works outings. We think this is a most undesirable procedure.

Our principle is to ignore such requests, and if other firms would take the same stand, it would considerably minimise this mild form of blackmail.

HIGGS MOTORS,
Birmingham, *May 12th*, 1931. *Walter F. Higgs.*

Vacuum Cleaners

There are numerous vacuum cleaners advertised in the ELECTRICAL REVIEW and yet not one of the advertisers gives the duty of the fan, say, in cubic feet of air handled per minute, also the total water gauge set up.

This information would enable purchasers to obtain these machines on a practical basis, whereas at the present time the specifications convey little.

Hull, *May 12th*, 1931. H. WHELDON.

Book Reviews

Hydraulics for Engineers, including Turbines, Pumps, and Unsteady Motion. By ROBERT W. ANGUS, B.A.Sc. Pp. xii+304; with 161 diagrams and illustrations. London: Sir Isaac Pitman & Sons, Ltd. Price 12s. 6d. net.

The subject of hydraulics is becoming of increasing importance to electrical engineers, not only because of the rapid developments which are being made in the science and practice of hydro-electric engineering—that is to say, the generation of electricity from water power—but because in modern power station practice, using either steam turbines or internal combustion engines as the prime movers for driving the electrical generators, pumps form a very important part of the auxiliary machinery. In the book under review the author certainly, and, we may add, inevitably, pays greater attention to the former, but as his sub-title indicates, the latter, in so far as it is concerned with centrifugal pumps, is not overlooked. The subject matter is divided into three parts, the first covering what we may term the usual theories of hydraulics and including the steady flow of water in pipes, orifices, weirs, and open channels; the second dealing with hydraulic or water-power turbines; while the third represents a rather unusual but, nevertheless, important section from the practical engineer's point of view, *viz.*, non-uniform flow, which includes the effects of dams in rivers and streams, surge tanks and water-hammer in pipe lines.

The outstanding feature of the book considered as a whole is its eminently practical outlook. The author, who is the professor of mechanical engineering at the University of Toronto, has practised for 30 years as a hydraulic engineer, and he writes not only for the student but also for the practising engineer, the former of whom does not take kindly to advanced mathematics, while the latter has generally forgotten the pure mathematics that he may have learned at college. Hence, while in this subject mathematics is unavoidable, he is content to leave unproved those results which demand anything more advanced than the solution of quadratic equations. The result is a book which is easily understandable, but which, nevertheless, is sufficiently advanced to enable the student, the designer, or the consulting engineer to solve almost any problem with which he may be faced. As is only to be expected, the text follows American practice, but this is not necessarily a disadvantage as the great continent of North America covering the United States and Canada may correctly be regarded as the home of hydro-electric engineering. The work is, moreover, thoroughly up-to-date, the various coefficients, &c., used in design work being taken from the most recent papers, while his descriptions of typical installations represent the latest practice. Thus, for his description of a water turbine of low head, he considers the unit of 12,000 h.p. at 26 ft. head recently installed at the Back River station of the Montreal Light & Power Co., while for a high head unit he describes the twin Pelton wheel of 56,000 h.p. at 2,200 ft. head at the Big Creek station of the Southern California Edison Co. We are pleased, also, to see references to the use of models in hydraulic work, which is becoming a recognised part of modern practice. The book certainly merits a place on the bookshelf of all who are in any way connected with hydro-electric engineering.

The Elementary Theory of the Internal Combustion Engine. By F. W. LUDLAM, B.Sc. Eng. (Lond). Pp. 86; figs. 13. London: Blackie & Son, Ltd. Price 3s. 6d. net.

It is admittedly more difficult to write an elementary text book than an advanced one because the writer has to express himself not in the language with which he is familiar but in terms which will be easily understood by his less highly-trained reader. This little work, excellent as it is in many ways, is not free from blemishes, although they are not sufficiently serious to deter us from recommending it to any student or engineering apprentice who is desirous of studying the elementary theories underlying the operation of the internal combustion engine. The work is, the author tells us, intended for students who are not too well equipped mathematically, and yet he deduces the formula for the efficiency of the engine working on the Diesel cycle, giving it finally as:—

$$E = 1 - \frac{1}{\gamma} \cdot \frac{\frac{1}{r_c^{n-1}} \left\{ \left(\frac{r_e}{r_c} \right)^n - 1 \right\}}{\frac{r_e}{r_c} - 1}.$$

When it is recalled that n is not a whole number we may be permitted to ask what student "not too well equipped mathematically" could evaluate this expression. Elsewhere, and in a different category of difficulties, we note that the author refers to a perfect gas without endeavouring to explain what is implied by a perfect gas. As a last indication of the difficulty of getting down to the level of the elementary student, we venture to refer to the absence of simple line diagrams showing the relative position of the piston in the cylinder, the opening or closing of the admission and exhaust valves or ports during the various practical cycles of operation which are utilised commercially on internal combustion engines at the present time. To attempt to describe the difference between the four-stroke cycle and the two-stroke cycle without the aid of simple diagrams appears to us to be a defect which could easily be remedied. But, as we have said, the book has distinct merits from the point of view of the elementary student. The author gives a careful investigation of the laws of gases and the principles underlying the conversion of heat into work, while his chapter on the actual performance of internal combustion engines, the figures for which are taken from tests on commercial engines is of distinct value. There are many numerical exercises worked out in the text, while at the end of each chapter a number of examples is given the answer to each of which is to be found at the end of the book.

Electrical Insulating Materials. By H. WARREN, M.I.E.E., A.M.I.A.E. Pp. xviii+516; full illustrated. London: Ernest Benn, Ltd. Price 42s.

Progress in the manufacture of insulating materials has been rapid during recent years, but there is still much groping in the dark. While a substance may have a high ohmic insulation resistance, it may, nevertheless, often be characterised by a lower disruptive strength than a substance of far lower ohmic insulation resistance. It is the purpose of the writer of the volume under review to set forth in serviceable form the information and experience which he has accumulated on this subject, to which he has made some notable contributions on the technical development of some of the synthetic organic binders used in moulded insulations. The author emphasises the necessity of a high degree of scientific control in manufacture; with the increasing tendency towards higher voltage and larger units a still greater degree of reliability will become necessary.

The volume is divided into seven sections and deals particularly with materials and manufacturing processes, covering the engineering aspects of all the important types of insulators used in the construction of electrical plant. The outstanding section of the volume is the one devoted to moulded composite insulators, upon which the author is so well qualified to write. Commencing with a discussion of moulded insulations, followed by chapters dealing with natural and synthetic organic binders, he proceds to discuss moulded compounds with natural, rubber, hydraulic cement, and synthetic resin binders, followed by chapters dealing with the various aspects of mouldings, mould designs and moulding appliances. Section five of the volume gives an able summary of the applications of varnishes, enamels, filling compounds, and mineral oils. These compounds are often the sole means of preventing access of moisture and frequently constitute the principal insulating films upon which successful operation depends. The book is clearly written and well printed, and the numerous illustrations considerably add to an understanding of the subject matter. It constitutes not only a very complete review of the position up to date, but contains much original matter, rendering it a great advance on anything previously attempted. Those desirous of becoming acquainted with the remarkable progress made in connection with electrical insulating materials during recent years can be confidently recommended to study this volume.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1929

30,419. "Electrode systems for rectification purposes having unsymmetrical conductivity." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 7th, 1929. (346,653.)

30,769. "Protection of electric mercury-arc rectifiers." Akt.-Ges. Brown, Boveri, et Cie. December 3rd, 1928. (346,764.)

33,043. "Means for recording sound on, and reproducing sound recorded on, a kinema film." B. Southwell. August 23rd, 1930. (346,851.)

34,640. "Automatic telephone systems." Standard Telephones and Cables, Ltd., T. S. Skillman, L. G. Freeth, and R. J. Berry. November 13th, 1929. (346,766.)

36,262. "Electromagnetic vibratory devices, such for example, as sound reproducing or recording devices." Wireless Music, Ltd., M. Tronton, R. E. H. Carpenter, and F. G. G. Davey. November 26th, 1929. Cognate application 39,918/29.) (346,852.)

37,556. "Electrode rod or wire holders for electric welding." J. Shirley, J. Paterson, and Premier Electric Welding Co. December 7th, 1929. (346,745.)

38,032. "Totalisators." British Thomson-Houston Co., Ltd., and A. J. Johnston. December 11th, 1929. (346,657.)

38,314. "Electric signalling devices for ships." A. Graham and Co., Ltd., and C. H. Vaughan. December 14th, 1929. (346,659.)

38,855. "Microphones." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. December 18th, 1929. (346,807.)

38,945. "Electric glow discharge devices." British Thomson-Houston Co., Ltd. December 19th, 1928. (346,808.)

39,282. "Electric protective arrangements." British Thomson-Houston Co., Ltd., S. J. Lane and L. Bennett. December 23rd, 1929. (346,854.)

1930

93. "Electrical resistances arranged in flexible cords." D. Perlusz. January 1st, 1930. (346,660.)

218. "Wireless receiving apparatus." J. Robinson. January 2nd, 1930. (346,811.)

734. "Thermionic amplifying systems." Marconi's Wireless Telegraph Co., Ltd. (T. A. Smith). January 8th, 1930. (346,666.)

1,006. "Tanks for drying, vulcanising, accommodating, or impregnating electric cables." H. Sonnenfeld. January 10th, 1930. (346,704.)

1,364. "Mains-operated wireless receiving apparatus and the like." L. F. Savage, E. H. N. Wright, and Radiovolt, Ltd. January 14th, 1930. (Cognate applications, 14,856 and 16,082/30.) (346,780.)

1,471. "Electric terminal connections, particularly intended for use in ignition circuits." North & Sons, Ltd., and A. Massey-Allen. January 15th, 1930. (346,712.)

1,478. "Photo-electric cells." Standard Telephones & Cables, Ltd. (W. T. Gibson). January 15th, 1930. (346,713.)

1,479. "Automatic or semi-automatic telephone exchange systems." Standard Telephones & Cables, Ltd. (W. Hatton). January 15th, 1930. (346,714.)

1,480. "Signalling arrangements in telephone trunking systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). January 15th, 1930. (346,715.)

1,481. "Driving arrangement for power driven switching-apparatus." Standard Telephones & Cables, Ltd. (G. Deakin). January 15th, 1930. (346,716.)

1,487. "Electrical frequency-changing circuits." Standard Telephones & Cables, Ltd. March 30th, 1929. (346,717.)

1,570. "Gas-filled electric switches." F. Perrotti. January 16th, 1930. (346,823.)

1,600. "Method of and means for controlling electric circuits." H. J. Osborn, and A. Wright. January 16th, 1930. (346,825.)

1,783. "Method of manufacturing vulcanised-rubber insulated electric conductors." Standard Telephones & Cables, Ltd. (J. R. Pheazey). January 17th, 1930. (346,789.)

1,784. "Telephone systems." Standard Telephones & Cables, Ltd., T. S. Skillman, and L. G. Freeth. January 17th, 1930. (346,790.)

1,813. "Engine governing systems and apparatus." Associated Electrical Industries, Ltd. January 19th, 1929. (346,832.)

1,820. "Thermionic valve systems and apparatus." C. L. Richards, J. L. Baird, and Television, Ltd. (in liquidation). January 18th, 1930. (Addition to 336,655.) (346,834.)

1,895. "Mains operated voltage amplifier." Dr. S. Loewe, and M. Von Ardenne. January 22nd, 1929. (346,840.)

2,356. "Electrical contact-making means, specially applicable for use in conjunction with shaft revolution indicators and the like." A. Graham & Co., Ltd., and W. J. Rickets. January 23rd, 1930. (346,859.)

2,388. "Safety switch applicable to electric accumulators and batteries for automobile vehicles." S. H. Muffett. January 23rd, 1930. (346,861.)

2,413. "Electric batteries composed of single cells or elements adapted to be connected in series or parallel." V. England-Richards. January 23rd, 1930. (346,862.)

2,435. "Equipment for the reproduction of sound." Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). January 23rd, 1930. (346,863.)

2,797. "Electric signal transmitting systems." Siemens and Halske Akt.-Ges. July 27th, 1929. (Addition to 345,016.) (346,875.)

6,070. "Process for reducing the electric charge of textile fibres." Aceta Ges. March 11th, 1929. (346,912.)

6,292. "Beacon lights." J. B. Bartow, and C. T. Ludington. February 25th, 1930. (346,915.)

7,079. "Apparatus for measuring alternating electric magnitudes." Soc. Anon. Off. Elettromecc. Scarpa & Magnano. March 6th, 1929. (346,926.)

7,603. "Automatic or semi-automatic telephones systems." Coventry Automatic Telephones, Ltd., B. F. Moss, and T. R. Hockney. March 8th, 1930. (346,932.)

7,632. "Tumbler switch combined with a plug and socket." Lüdenscheider Metallwerke Akt.-Ges. Vorm J. Fischer & Basse. February 18th, 1930. (346,933.)

7,908. "High-tension insulators." British Thomson-Houston Co., Ltd. March 12th, 1929. (346,935.)

8,317. "Luminous circuit charts." Siemens & Halske Akt.-Ges. March 16th, 1929. (Addition to 283,893 and 294,225.) (346,942.)

8,684. "Methods of eliminating the residual air from electrical insulations." International General Electric Co., Inc. March 19th, 1929. (346,948.)

8,854. "Methods of manufacturing electrical insulating material." International General Electric Co., Inc. March 21st, 1929. (346,951.)

8,885. "Counting arrangements for electric signalling systems." Ericsson Telephones, Ltd., and J. W. Ginever. March 20th, 1930. (346,952.)

9,096. "Electrical apparatus for transmitting indications to a distance." Allgemeine Elektricitäts-Ges. March 22nd, 1929. (346,956.)

9,097. "Electron discharge devices." British Thomson-Houston Co., Ltd. March 23rd, 1929. (346,957.)

9,348. "Electric power transmission systems employing rotary convertors." E. W. Seeger, and N. L. Mortensen. March 25th, 1929. (346,960.)

10,682. "Flicker producing devices for electric fires and other electrically illuminated appliances." F. L. Newhouse. April 4th, 1930. (346,979.)

10,689. "Electric switches and the application of switches to electrically-heated kettles, toasters, and the like." J. A. Crabtree. April 4th, 1930. (346,980.)

11,552. "Electric terminal boards." Siemens Bros. & Co., Ltd., and E. A. Petithory. April 11th, 1930. (346,987.)

13,019. "Electric circuit interrupters." Associated Electrical Industries, Ltd. April 27th, 1929. (347,007.)

13,184. "Zinc-lead electric accumulators." A. Pouchain. May 8th, 1929. (Addition to 290,665.) (347,010.)

13,203. "Electric discharge devices." British Thomson-Houston Co., Ltd. April 29th, 1929. (347,011.)

13,464. "Electrical accumulators." H. Wehrlin. May 29th, 1929. (347,012.)

13,949. "Electric incandescent lamps with reflectors." A. E. O'dell (Elektrotechnische Fabrik Schmidt & Co., Ges.). May 6th, 1930. (347,017.)

14,063. "Thermionic detector circuits." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 20th, 1929. (347,018.)

15,002. "Arrangements for the reproduction of films having recorded on them sound and optical images." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 1st, 1929. (347,026.)

16,193. "Electric ignition switch indicators for motor vehicles." G. Unterberg. March 26th, 1930. (347,037.)

18,036. "Apparatus for wireless signalling." General Electric Co., Ltd., N. J. McAinsh, and F. Clark. June 12th, 1930. (347,047.)

18,097. "Plant for the distribution of electric power." Ruthsaccumulator Aktiebolag. June 26th, 1929. (347,049.)

21,799. "Means for automatically controlling the frequency of alternating current systems." British Thomson-Houston Co., Ltd. July 24th, 1929. (347,066.)

22,460. "Bi-metal electric cut-outs." Felten & Guilleaume Carlswerk Akt.-Ges. August 19th, 1929. (347,073.)

23,211. "Synchronous driving of television and picture transmitting apparatus." Telehor Akt.-Ges. August 29th, 1929. (347,078.)

23,579. "Commutators for dynamo-electric machines." Associated Electrical Industries, Ltd. August 10th, 1929. (347,080.)

25,880. "Production of sound effects by means of thermionic valve oscillators." Dr. P. Lertes, and B. Helberger. August 31st, 1929. (347,082.)

27,683. "Transformer-coupled thermionic amplifiers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 28th, 1929. (347,085.)

29,102. "Dynamo electric machinery." English Electric Co., Ltd., J. P. Chittenden, and J. A. Osborn. September 29th, 1930. (347,087.)

1931

3,339. "Sound-reproducing apparatus." F. P. Dehn (General Talking Pictures Corporation). December 9th, 1929. (Divided application on 344,917.) (346,762.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 6th:—

Invader. No. 521,509. Class 8. Wireless telephonic apparatus and parts thereof.—McAulay, McIlroy & Co., Ltd., 55, Rosemary Street, Belfast.

Urania. No. 521,163. Class 8. Wireless telegraphic and telephonic apparatus and parts thereof.—Elektrochemische Fabrik Alfred Baehr Gesellschaft, 18-19, Lindowerstrasse, Berlin, N.65, Germany (British representative, D. Grabow, 19, Minster Road, N.W.2).

Nestoria. No. 521,487. Class 8. Wireless telephonic and telegraphic apparatus, electric batteries, cells, accumulators, coils, resistances, rheostats, searchlight apparatus, fitted electric switchboards, and voltmeters.—Tekade Radio & Electric, Ltd., 29, Farringdon Street, E.C.4.

Human Figure (design only). No. 518,715. Class 11. Apparatus (not medicated) for surgical and curative purposes for use in the production of ultra-violet rays.—Naamlooze Vennootschap Pharmaceutische Producten Maatschappy Philips-Van Houten, Amsterdamscheweg, Weesp, Holland (British representatives, Dicker, Pollak & Mercer, 20-23, Holborn, E.C.1).

Boda. No. 519,026. Class 13. Electrodes of ordinary metal.—Allen-Liversidge, Ltd., Victoria Station House, S.W.1.

Chequered design only. No. 514,974. Class 13. Metal goods for use in electric lighting, heating, signalling and power installations.—Simplex Conduits, Ltd., Garrison Lane, Birmingham.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Alterations and extensions to the District Nursing Association at Ingleboro' House; C. George, architect, 37, Dee Street.

ABERDEENSHIRE.—School at New Pitsligo (£6,813) and reconstruction of Rhynie School (£3,307); county architect, Aberdeen.

ABERYSTWYTH.—University buildings for the Court of Governors of Aberystwyth College (£500,000); H. V. Lanchester, architect.

ALTON (Hants.).—Houses (65) for the U.D.C.; G. H. Webb, surveyor.

BAKEWELL.—Cinema, Market Street; Marsden & Son, builders, Youlgrave.

BARNSLEY.—Additions to classrooms at Racecommon Road Council School for the E.C. (£7,000); P. Dalby & Son, builders, Kensington Road.

BARROW-IN-FURNESS.—Child welfare centre and dental clinic (£6,000), and Town Hall; borough surveyor.

BERWICK-ON-TWEED.—Extensions, High Street, for J. Dunlop and Son; Councillor H. Stuart.

BILLERICAY.—Extensions, Infectious Diseases Hospital, for the R.D.C.; H. R. Bird, architect, St. Thomas' Gate, Brentwood.

BIRKENHEAD.—Extensions, General Hospital (£40,000); secretary. Development of Manor estate for Hamilton Estates, Ltd.; T. Wainwright & Sons. Development of Preston estate for A. H. Boulton; W. Griffiths & Son.

BIRMINGHAM.—Church, Lytelton Road, Stetchford; Swift and Sons, builders, Alcester Street. Church, Peckham Road; Birmingham diocesan trustees. Re-erection of factory, Bolton Street, for Halliday & Lawrence, Ltd. Schools, Yardsley, and Kettlehouse Farm estate; also extensions to Central Technical and Commercial College (£12,700) for the E.C.

BLACKBURN.—Church; Rev. A. Smith, vicar of St. Gabriel's.

BOLLINGTON (Ches.).—Houses (36), Bollington Cross housing site, for the U.D.C.; Willis & Co., builders, Charlesworth Street, Stockport.

BOLTON.—Houses (90), various sites; borough engineer.

CHELTENHAM.—Bakery, Hewlett Road; J. Brunner.

CHESHIRE.—Schools, Altrincham and Higher Bebington, for the county E.C.

COLCHESTER.—Infants' school, Barrack Street area; A. D. Robinson, architect.

COULSDON.—Houses (32), Ridgemount Avenue; A. G. Cresswell. Houses (100), Woodland estate; U.D.C. surveyor.

CREWE.—St. Andrew's church; J. T. Gresty, builder, Willaston.

CUMBERLAND.—Extension of the county secondary school, Whitehaven (£20,000); director of education, The Courts, Carlisle.

DORMANSTOWN (Yorks.).—Parish church; vicar.

DOVER.—Houses (42) for the T.C.; borough surveyor.

DUDLEY.—Houses (190), By-pass Road; borough engineer. Stores, Stafford Street; Daily Bread, Ltd.

DURHAM.—Admission hospital, mental colony (£41,000); county architect.

EASTBOURNE.—Alterations, Glendower Hotel, Burlington Place; Clarke & Worsfield, architects. Alterations, West Hill School, Hill Road; B. Stevens, architect.

EAST RETFORD.—School (400 places) for the E.C.

EDWINSTOWE.—Extensions to Council school (£5,326); Greenwoods (Mansfield), Ltd.

ESSEX.—Science block, &c. (£6,370), King Edward VI School, Chelmsford, junior school, Tilbury, and central schools, Manningtree and Lawford, for the county E.C.; director of education, Chelmsford. Extensions, Maldon Grammar School (£8,287); T. J. Bailey, builder, Chelmsford. Extensions, Epping School (£7,699); F. Hutton & Sons, builders, Birch.

FARNHAM (Surrey).—Alterations, Palace Cinema, for County Cinemas, Ltd.; H. G. Baker.

FARNWORTH.—Showrooms, &c., Market Street, for Montague Burton, Ltd.; W. Townson & Sons, Ltd., builders, Parkhill Street, Bolton.

FELLING.—School at Heworth for the E.C.; F. Hall, surveyor.

GLOUCESTER.—School, Finlay Road (£19,000), for the city E.C.; education architect.

GOLCAR (Yorks.).—Cinema theatre, James Street, for A Wood.

GOOLE.—Church for St. Mary's parish; Rev. H. E. Wall.

GRAVESEND.—Houses (192) for the T.C.; Eadie Towers & Co., Ltd., builders, Wolverhampton.

HORNCHURCH (Essex).—Houses (78), Glanville Drive, for Standen Bros.

HORSFORTH (Nr. Leeds).—Cinema, New Road, for E. C. Briggs, builder, The Granges, Hall Lane.

HULL.—Cinema; H. Benwell, architect, Southam Chambers, Waltham Street. Fire station, Southcoates Lane (£10,768); J. H. Fenwick & Sons, Ltd. School, Beverley High Road (£15,632), and extensions to Hymers College (£10,101); R. G. Tarran.

HUNWICK.—Extensions to Council school (£7,854); R. Barron and Co., Ltd., Coundon, Durham.

IRISH FREE STATE (Edenderry, King's County).—Houses for the Town Commissioners; J. J. Bruntz, architect, St. Anne's, Clonmore. (Letterkenny, Co. Donegal).—New wing, St. Eunan's College, for the Bishop of Raphoe; Wm. H. Byrne & Son, architects, 20, Suffolk Street, Dublin. (Limerick).—Technical school at Hospital (£3,200) for the C.C.

KENT.—Central school, Walmer, for the county E.C.; director of education, Maidstone.

KIRKCUDBRIGHTSHIRE.—School, Galston, for the county E.C.; W. A. Mackinnell, architect, Kirkcudbright.

LANCASHIRE.—Schools, Denton and Whitefield; director of education, County Offices, Preston.

LARGS (N.B.).—Extension of business premises, Boyd; Greenock Central Co-operative Society. Extension of the police station (£3,500); surveyor to the Council.

LIVERPOOL.—Secondary school, Wavertree, for the E.C.

LONDON.—(Bermondsey).—Enlargement of County Secondary School (£19,000); L.C.C. architect. (Bow).—Extensions to Old Palace School (£3,250); R. Woollaston & Co. (Camberwell).—Alterations, Constance Road Infirmary (£9,100); reconstruction of Credeon Street School (£36,500); L.C.C. architect. (Chelsea).—Building works, Lots Road pumping station (£28,250); C. Brand & Son. Extensions to Polytechnic (£12,250); governors. (Ilford).—Houses (39), Hickman Road; W. M. Edwards. Houses (33), Mayesford Road and Vinta Drove; F. G. Ashton & Son. Houses (32), Park View Gardens; J. Aldridge. Houses (33), Roxy Avenue; F. Stimpson. Extensions, Longbridge Road; London General Omnibus Co. Baptist chapel and school, Cleveland Road; F. G. Founch. (Islington).—Alterations to Blundell Street School (£4,357); L. H. & R. Roberts. (Kensington).—Clearance scheme, Baker Street area; borough engineer. Shops and flats, High Street and Argyll Road; Morris Estates, Ltd., 14, Regent Street. (Lewisham).—Rebuilding scheme, High Street, for Sainsbury's Furnishing Stores. (Southwark).—Conversion of Elephant and Castle Theatre to cinema; Associated British Cinemas. (Streatham).—Houses (130), flats (200), and maisonettes (156), Magdalen Park estate; R. M. Pigott, architect, Wandsworth B.C. (Waterloo).—Extensions to Morley College; governors.

LOW FELL (Gateshead).—Houses (300) (£160,000); E. P. Calderwood, contractor, Chow Dene.

LYTHAM ST. ANNES.—Branch bank at Cartmell Road, Fairhaven, for the District Bank, Ltd.; J. Sutcliffe & Sons (Builders), Ltd., builders, Alexandria Drive.

MABLETHORPE (Lincs.).—R.C. Church, Seaholme Road; priest in charge.

MAIDENHEAD.—Houses (30), Boyn Valley, for the T.C.; borough surveyor. Telephone exchange, Littlewick Green, for H.M. Office of Works, King Charles Street, London, S.W.

MANCHESTER.—Houses (438), Blockley, and Boggart Hole Clough (550), and school, Collyhurst (£17,000); city architect. Skating rink, Wilmslow Road, Rusholme; P. Cummings, architect, 27, King Street.

MIDDLESBROUGH.—Houses (100) for the T.C.; borough engineer. Baths for Corporation (£40,000); G. Bailey, Ltd., contractors, King Street, South Shields.

MIDDLESEX.—School, Southgate, for the County E.C. (£31,490); H. Knight & Son, contractors, Tottenham. Enlargement of Western Road School, Southall, for the C.C. (£7,139); Fassnidge & Son, Ltd., contractors, Uxbridge.

NANTWICH.—Houses (60) for the U.D.C.; surveyor.

NEWBIGGIN-BY-THE-SEA.—Extensions to promenade (£10,000); P. Lumsden & Co., Ltd., contractors, 25, Oxford Street, Newcastle-on-Tyne.

NORTH RIDING.—School (300 places), Clifton, for the county E.C.; education architect, Northallerton.

NOTTINGHAM.—Extensions to County Mental Hospital (£34,817); Bosworth & Lowe. Secondary school, Loughborough Road, Bardgford, and extensions to Healdswood school, Skegby, for the County E.C.

PLYMOUTH.—Showrooms and offices, Cobourg Street; Reeds, Ltd.

PORT TALBOT.—Houses (50), Newbridge Road; borough engineer.

PRESTON.—St. Oswald's Church, Holme Slack; W. J. Tapper, architect.

PRESTWICH.—Houses (56), Daneshill; the surveyor to the U.D.C., Town Hall.

SEAFORTH.—Alterations and additions to County Police Station; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

SHEFFIELD.—Houses, Greenhill estate (£66,000), Manor estate (128), and Longley estate (22); city architect. Houses (288), Shiregreen estate (£110,262); J. Laver & Sons, Ltd.

SILEBY (Leicestershire).—Primitive Methodist church; trustees.

SOUTHAMPTON.—Re-building business premises, Bargate, for Curry's, Ltd.

STAPLEFORD.—School, Hickings Lane (£8,050); Hofton and Sons, Beeston, Notts.

STOKE-ON-TRENT.—Church for the Parochial Council of St. Chad's Tunstall (£14,000); F. R. Lawson, 36, Glebe Street.

SUNDERLAND.—Houses (217), Grangetown site; Mr. Collinge, borough engineer.

SURREY.—Mentally defective colony, Botleys Park, Chertsey, for the C.C.; clerk, Kingston-on-Thames.

SUTTON-IN-ASHFIELD (Nottingham).—Houses (76) for the U.D.C.; Warner & Dean, architects, Mansfield Road.

TAUNTON.—Houses (40) for the R.D.C.; surveyor.

TEDDINGTON.—Municipal offices and fire station (£44,500); U.D.C. surveyor.

TORQUAY.—Bank, Union Street; National Provincial Bank, Ltd. Schools, Cary estate and Ellacombe, for the E.C.

TUNBRIDGE WELLS.—Houses (50), Rusthall, for the T.C.; borough surveyor.

TYLDESLEY (near Manchester).—Houses (52), Mosley Common site; surveyor to U.D.C., Town Hall.

WALLASEY.—Extension of Oldershaw Boys' and Girls' School (£26,000); director of education.

WALSALL.—Houses (141), Bentley estate (£41,865); J. Hickin and Sons, Willenhall.

WATFORD.—School (640 places), Leggatts Way; S. Dawe, architect, Rickmansworth.

WEST HARTLEPOOL.—Infectious diseases hospital (£35,000) for the T.C.; F. Durkin, borough surveyor.

WISHAW (Lanarkshire).—Factory buildings for Overtown Hosiery Co.; the manager.